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THE NATURALIST BRAZILIAN EXPEDITION.

PAPER I.—FROM RIO DE JANEIRO TO PORTO ALEGRE.

BY HERBERT H. SMITH.

THE coasting steamers from Rio de Janeiro to Montevideo keep almost constantly within sight of land—rugged gneiss mountains of the Brazilian coast range, giving place, beyond Santa Catharina, to lower hills. Finally, near S. lat. 29°, the rocks disappear altogether; in their stead appear rows of sand-dunes, often a hundred feet high, and extending inland as far as the eye can distinguish them. These dunes, stretching interminably along the shore, produce a curious mingled feeling of picturesqueness and desolation; piled and massed like snow-drifts, broken and repiled by the winds in strange forms, they have an almost mountainous outline. But the eternal still white is a fatigue to the eye; in most places one looks in vain even for the dusty bushes which usually grow in such places. Now and then a lonely fisherman's hut is descried or a half-buried wreck—grim relic of the dreaded *pampero*, or of the north-east "Carpenter wind," so-called because it strews the beach with planks and spars. All this coast is regarded as dangerous. It is entirely without harbors or shelter of any kind, and there are several shoals and sunken rocks, dreaded by mariners.

The sand-dunes form the seaward limits of Rio Grande do Sul, the southernmost province of Brazil. But they are not continuous with the mainland; a few miles back there are two great fresh-water lakes, parallel with the coast, and together extending along nearly the whole length of the province. The larger and

more northerly of these is called *Lagoa dos Patos* (Lake of the Ducks); the *Lagoa-mirim* (Smaller Lake) empties into this through the River Sao Gonçalo. Between the lakes and the ocean the dunes form two long peninsulas, varying in width from five to twenty miles. These peninsulas are entirely composed of sand, the drifted masses varied only with mangrove swamps and brackish or fresh-water lakes. They are perfectly barren, and almost without inhabitants.

The Rio Grande is the only passage through this sand-wall, and with some trifling exceptions the only outlet of the rich and populous province of Rio Grande do Sul. It is a shallow channel, twelve or fourteen miles long, half a mile wide at the ocean end, and gradually broadening towards the lakes. Unfortunately a very dangerous sand-bar has been formed before the mouth, which is yearly growing worse, and of late has caused serious apprehensions for commerce. In its formation this bar is altogether different from the shallows commonly found at the mouths of rivers. It has been built up, in great part, by the ocean currents and the north and north-west winds. The winds take up great clouds of sand from the dunes, scattering them broadcast before the channel; the currents sweeping south-westward along the coast catch up the sands as they fall, piling them in great banks over the shallows. The slight outflow from the Rio Grande serves to keep the detritus from accumulating directly in its mouth, and the bar forms a great semicircle around it. The Rio Grande itself brings very little sand or mud to the sea; I question, indeed, whether the tides are not washing the sea-coast sands through the channel into the lakes.

The condition of the bar varies greatly, more with the winds than with the tides; a long-continued south or south-west wind piles up the water, but even at the most favorable times the depth is seldom more than ten or eleven feet, and with a north wind the banks are almost dry. With a gale or even a strong east wind the bar becomes impassable on account of the surf; with a calm it is apt to shallow rapidly. Worst feature of all, these changes take place very suddenly and at irregular intervals, so that the bar is the very emblem of fickleness among the Rio Grande sailors. Old residents say that during the early years of this century the bar was even worse than it now is; about 1820 it was broken by a heavy storm, and after that, for forty years or

more, it gave little trouble. Since 1860 it has been constantly growing worse; two of the three channels are now impassable and the other threatens to become so. The Brazilian government has several times sent engineeers to study the obstruction, and many schemes have been proposed for its removal, but all have been more or less visionary and the expense involved by carrying them out would be enormous. Yet the importance of the question is very great. A region as large as New England and with a thriving population of over 700,000 is threatened with complete commercial isolation. For if the Rio Grande channel is closed, all the lake ports will be shut off from communication with the ocean; the sea-coast itself is without harbors, and the nearest ports of Santa Catharina could only be reached by long and expensive railroads. It has been proposed to cut a ship canal from one of the lakes to the ocean, at some favorable point, and perhaps this would be feasible, but it would be necessary to make an artificial port at the ocean end of the canal, and even if the works were successfully completed, their utility might soon be destroyed by the formation of new sand-bars. In the midst of these conflicting schemes the Rio Grandenses are anxiously looking for another great storm which shall once more open their ports to the world.

As we approached this doughty bar we counted a dozen vessels lying outside, waiting for an opportunity to enter; some of them, we were told, had been there for six months. Inside of the bar at least an equal number were waiting for an exit. When the weather permits it a small boat is anchored over the bar, and soundings are constantly taken from it with poles; the depth is indicated by signal flags from the boat and from a tower on the shore. Owing to the sudden changes ship-masters are obliged to watch these signals very closely, so as to profit instantly by a favorable indication. We heard of one poor fellow, an American skipper, I believe, who had fretted and fumed for four months inside of the imprisoning bar; his small fortune was dependent on the success of a voyage for which he had contracted, and which the bar threatened to prevent. One day the signals suddenly went up to twelve feet, the depth which his ship required. Overjoyed he at once weighed anchor and ordered all sails to be set; but as he approached the bar the flags came down again, and he was obliged to turn back. The chagrin and disappointment were

so great that some brain trouble ensued, and the man died that night. Other ship-captains under similar circumstances have pushed on in spite of the risk, trusting to good luck to scrape through the obstruction; half a dozen wrecks lying on the shallows show the results of such hardihood.

Luckily for us the signals marked eight feet and three inches, just our draught, and we were able to pass without stopping. Led by the little pilot-steamer, ycleped *Manoel o Diabo* (Emanuel the Devil) we threaded the crooked channel, scraping a little in the shallowest part, where the surf was lively enough. In the Rio Grande the navigation is still somewhat difficult, and the deeper portions are marked out with buoys.

Eight or nine miles from the sea, on the western side of the channel, is the city of Rio Grande, the commercial metropolis of the province. It is built on a peninsula of the sand-dune region, but the main streets are well paved, and some attempts have been made at arborization; there is a fine public garden where willows and palm-trees are intermingled, and roses and dahlias grow side by side with splendid tropical camellias. Hedges near the city are formed of large shrubby mimosas, or of candelabra cacti (Cereus). In one place a grove of Eucalypti has been planted, and the trees appear to thrive well. The only plants that grow naturally on the peninsula are the marsh grasses and reeds, the mangrove bushes and a few inconspicuous herbs. Yet it is said that with the addition of a small amount of fertilizing material, the land may be made very productive; in fact, the Rio Grande market is abundantly supplied with vegetables which are thus grown on sand-islands near the city.

Rio Grande contains about 14,000 inhabitants, mostly whites of Portuguese descent, though there are a good many foreign merchants. The city is exclusively dependent on commerce for its existence, the country immediately around it producing almost nothing. The principal articles of export are jerked beef and hides, with much tallow, horns, wool, tobacco and rice, but no coffee, sugar or cotton. Rows of warehouses front the river, where a fine wide quay has been built; here large ships may discharge their cargoes directly on the land. There are some good public buildings, including one of the finest custom-houses in Brazil; this is covered with cement, in imitation of marble, and its architecture is much superior to that of most public works in the em-

pire. The market, like most of those in this province, consists of two rows of stalls, with a passage between, running around a great open court, in which are other stalls for the sale of fruit, vegetables and small wares. Fine grapes, grown in the province, were plenty here, and cheaper than in New York; pears, apples, peaches, tomatoes and so on were also native, but those we saw were high priced and not very good. Oranges, at this season (January), were scarce and dear, but from May to September they are very plenty, and hardly inferior to those of Bahia and Pernambuco.

Opposite Rio Grande, on the eastern side of the channel, is the village Sao José do Norte. Formerly this was the main port, and it is still used for coal, lumber and marine stores.

We stopped but a few hours in Rio Grande, our objective point being Porto Alegre, the capital of the province, which lies at the northern end of the Lagoa dos Patos. Communication between the two places is kept up by means of excellent small steamers, which leave Rio Grande once or twice every week. Our own voyage was somewhat uncomfortable and crowded, for in addition to the large number of first-class passengers, the decks were entirely occupied by nearly three hundred Italian immigrants who had just arrived. These were lively, and picturesque, and dirty, as the manner is with their race; as a class they appeared to be much superior to the average Italian immigrant of Castle Garden.

The river at Rio Grande is about two miles wide; generally fresh, but sometimes brackish or salt, with irregular and varying tides. Above this point it rapidly widens, but is much obstructed by sand-islands and shoals; the channel, a narrow and very crooked one, is indicated by rows of stakes. The river is simply a straitened continuation of the Lagoa dos Patos, but the southern end of the lake proper is considered to be at the island or shoal of Sarangonha, about fifteen miles above the city, and twenty-five from the sea. Just opposite this island, on the western side, is the mouth of the Rio de Sao Gonçalo, the outlet of the Lagoa Mirim. Steamers plying on the Lagoa dos Patos enter this river for a few miles to touch at the important little city of Pelotas, where the cattle-killing industry centers. The shores of the Sao Gonçalo are flat and reedy, with lines or clumps of low forest near the water's edge; ranges of hills appear a little inland, on the north-western side, but to the south a great sandy

or swampy plain extends to the ocean. The plain and the sandy islands in the lake are the resorts of many water-birds, white herons and ducks being particularly abundant. One species, called the *pato erminho*, or ermine duck, sometimes occurs in vast numbers, completely covering the small islands; from this bird the lake has taken its name. The skins of the *pato erminho*, with the larger feathers rubbed or pulled out, furnish a substance resembling swans' down; this is occasionally preserved by the Brazilians; but more as a curiosity than for use. It might be made a valuable article of export.

From Pelotas the steamers run directly to Porto Alegre, about twenty hours being occupied in the passage. The Lagoa dos Patos, through which our route lay, is the largest lake in Brazil, its length being over 130 miles, while its breadth varies from twenty to thirty-five miles. On the western side it is very shallow, and the shores are there bordered by swamps, which extend far inland; the only navigable channel is along the eastern side, skirting the sandy peninsula which separates the lake from the ocean. The winds sweep in freely over these low sand-hills, and in stormy weather the lake is very rough; navigation is then decidedly dangerous even for steamers. During the night we had a little taste of this in a heavy thunder-storm which broke over us, causing our small vessel to roll heavily; beyond this we suffered no inconvenience, and the storm soon passed; but to the immigrants on deck the night must have seemed a sorry introduction to their newly adopted country.

At its northern end the lake is split into two parts; the eastern one, bordering on the sand-dune region, receives several small streams; the western is a wide, deep estuary, called the Rio Guahyba. The mouth of the Guahyba is marked by rocky points on either side, but the lake may be looked upon as a continuation of the river. More broadly speaking, the lake is a geological result of the river; the long sand-spit which separates it from the sea has been formed by the joint action of the Guahyba and the ocean currents, probably during a period of subsidence. The formation of the lake is therefore similar to that of the sounds along the south-eastern coast of the United States. Only, in this case, the process has been carried farther; the lake has become almost completely separated from the ocean, and its waters are now fresh. I have not personally examined the Lagoa Mirim, but there can be

little doubt that it was formed in the same manner; after existing for some time as an estuary of the small rivers which now flow into it, it was closed by the sand-banks, and its waters emptied into the ocean by the Rio de Sao Gonçalo; the Guahyba estuary subsequently overlapped the mouth of the Sao Gonçalo, and when this estuary became a lake the Lagoa Mirim was reduced to the form of a tributary.

Owing to the shallowness of the lakes an immense evaporation takes place from them, and at certain seasons this nearly or quite balances the inflow from the rivers; salt water may then pass in from the ocean to the southern part of the Lagoa dos Patos, filling the Sao Gonçalo channel, and even extending far up the Lagoa Mirim. The yearly outflow from the lakes, owing to the same cause, is very slight. This fact explains the irregular and feeble currents of the Rio Grande channel, and it is the real cause of the heavy bar at its mouth. If the outflow were strong and regular, or only influenced by the tides, the bar would have at least one permanent and deep passage through it, or at worst the question of removing the obstruction might be solved by means of jetties.

The Guahyba is very picturesque. High granite hills skirt the eastern shore, sometimes bare and precipitous, oftener with grassy slopes and forest-lined ravines. A few rocky islets are scattered over the channel; one of them is used for a powder magazine and signal station, but there are no fortifications. For twenty miles above the lake the channel has an average width of five or six miles, but at Porto Alegre it is suddenly narrowed to less than a mile by two opposite projecting points. The southern point is low and bordered by swampy forest; the northern, on which the city is built, is a granitic promontory about 150 feet high. This elevation, slight as it is, adds greatly to the picturesqueness of the place; white and yellow-washed houses, with red tile roofs, are seen rising one above another, the public buildings crowning the hill with fine effect.

Of all Brazilian cities this is the least tropical in appearance, the architecture shows some traces of that degraded Roman type commonly seen in Spanish and Portuguese America, but even this is not very noticeable, and on landing we might have imagined ourselves in a seaport town of the United States. The streets are wide and well paved with porphyry from the surround-

ing hills, but they are badly drained and dirty—another reminder, perhaps, of New York and Philadelphia. For a wonder we found the hotels excellent and very reasonable in their charges; they all have French or Italian names, with what purpose it would be hard to say, for these nationalities are hardly represented in the city. There are about 35,000 inhabitants, mostly white Brazilians and Germans.

Standing on the summit of the promontory, near the president's palace, one may obtain a very close idea of the topography of the surrounding country. To the west and south, sweeping around the point, is the broad Guahyba; just above the city it is divided by many islands, receiving several branches which, spreading out like the fingers of a hand, have given to this part of the river the local name of Viamao (handway). Flat lands stretch away to the south-west, beyond the river; these are meadows and swamps, continuous with those which skirt the western side of the Lagoa dos Patos. To the east and north are beautiful rolling lands, once covered with forest but now occupied by pastures and farms; beyond these are other more rugged hills, forest or prairie-covered; and far to the north-west a blue flat-topped range can be descried, the edge of the interior table-land.

We made several short excursions around the city, noting the physical peculiarities of the region and getting our first glimpses of its fauna and flora. Lines of street cars run in various directions, affording very pleasant little excursions, and beyond these there are good roads and paths by the river-shore or among the hills and ravines. The country reminded us much of the Middle and Southern United States, yet there was a certain mingling of tropical features everywhere. The roads are broad and lined with hedgerows of mimosas and cacti; the houses, as usual, white-washed and tile-roofed, often with neat kitchen-gardens around them, where the tomatoes and cabbages reminded us yet more strongly of home. Roses and begonias grow half wild about the door-yards; peach and pear trees and rampant grape-vines running over trellises, are set off by rich, dark orange trees and great pale-green banana leaves. Everywhere there is the same mingling of tropical and temperate features; people, customs, architecture, animals and plants, the very air, changing from sultry to chill in a day, showed us that we were in a border-land, partaking of the character of two regions.

(To be continued.)

UNNATURAL ATTACHMENTS AMONG ANIMALS.

BY JOHN DEAN CATON, LL.D.

"THERE is no accounting for tastes" is an aphorism as applicable to the lower orders of animals as to the genus Homo. It had reference to exceptional incidents in connection with the affections, the inclinations, or social relations.

I propose to make a few observations on abnormal exhibitions of these as occasionally exhibited in the lower animals. I should not refer to the devotion of the dog to his master or the attachment the canary bird manifests to its mistress who feeds and caresses it, for the first is so common as to suggest that it arises from a natural impulse in our nature, while the other may be an acknowledgment of benefits received. These, like the attachments of individuals for each other among the various species, being common, we may consider them as natural, or the result of some natural law; but it is the abnormal or unnatural attachments, those which seem to violate some natural law which attract our attention.

A remarkable instance of this unnatural attachment occurred under my own observation in my acclimatization grounds at Ottawa, Ill., between a male wapiti deer and a heifer. I will quote the account I gave of the occurrence in "The Antelope and Deer of America," p. 315: "When I had but one male elk with several females, a strong attachment grew up between the buck and a two-year-old Durham heifer, so that he abandoned the society of the female elk as the heifer did that of the cows in the same inclosure with which she had been reared, and devoted themselves exclusively to each other. When they laid down in the shade to ruminate they were always found close together, and when one got up to feed, the other would immediately follow. They kept away by themselves, always avoiding the society of all the other animals. Whenever the heifer was in season, which occurred quite regularly once a month; she accepted the embraces of the elk without showing an inclination to seek the other cattle; nor did this seem to be the result of any constraint. This intercourse continued throughout the summer, during the entire season of the growth of the antlers of the elk, but unfortunately he was killed before the rut commenced with the female elk. It is hardly necessary to state that no impregnation ever occurred from her

intercourse with the elk. As far as this instance may go to establish it, we may conclude that the constitutional differences between the elk and the cow are so great that they cannot successfully interbreed."

Here we find a double anomaly of a very pronounced character. It was not enough that one of these animals should have an unnatural inclination which might not occur in one individual in many thousands of either species, but both must be possessed of this extraordinary inclination or affection, and these two unnatural animals must happen to meet together under favorable circumstances before this phenomenon could occur.

We may find some excuse for the wapiti in the fact of which I was informed when I bought him in St. Louis; that he had been taken when very young and brought up by hand by a farmer in Western Missouri, where he had no doubt associated with the cattle on the farm and had never seen one of his own species till turned into my grounds. Several years' intimate association with cattle would strongly tend to reconcile him to their society, if it did not create a real attachment to them, and so was the way paved, to a certain extent, which led to this unnatural association, but it must be added that he never paid the least attention to the other cows in the grounds when they manifested the same condition which no doubt first attracted his attention to the heifer. As for the heifer, I can only say that there was no bull in the grounds, nor had she ever seen one, so far as I know.

These are poor apologies, I confess, for such strange and unnatural conduct.

I was presented with a couple of sand-hill cranes, and as they differed in voice and gait, I supposed they were a pair, but when both began to lay eggs I found my mistake. Till they were three or four years old they associated together, and seemed on friendly terms at least, after that they separated and were never found together as associates. One of these, for a whole summer, attached herself to the pigs which ran in an adjoining park, into which she managed to escape. She was their faithful attendant the whole day. When they went to the spring for water she went with them, and when they laid down to cool themselves in the rivulet, she would sit down close to them and patiently wait till they chose to get up and go to grazing. She never tried to lead them or control their action, but seemed only too happy to

be their humble attendant. As for the pigs, I never saw any evidence to show that they cared anything for the bird. If her society was tolerated without rudeness, I could see nothing to indicate that it was desired or even agreeable. Several times during the summer the bird was put into her own enclosure, when she seemed to spend her whole time wandering up and down the dividing fence looking for the pigs, and if they wandered around near the fence, she manifested the greatest satisfaction, while if they approached the fence, it seemed rather accidental, or to lay down in its shade, where they could find a dirtier bed than they could on the grass under the trees. At any rate the presence of the crane on the opposite side did not appear to be the least attractive to them.

This was clearly a case of unrequited love, but it only lasted for that one season.

Four years ago last spring, I brought from Honolulu two pairs of Hawaiian geese (*Bernicla sandvicensis*). These are small, pretty geese, easily domesticated, semi-aquatic in their habits, and of rather social disposition. They are only natives of the Island of Hawaii. They live in the high mountains among the lava beds, and never go to the sea though they are of strong flight and fly to considerable distances over the ocean. They are first mentioned in the account of Cook's first voyage at the time he discovered Hawaii, when he procured a specimen for the table. They become much attached to a person who pets them. When the gentleman in Honolulu presented me with one of the ganders which I brought home, he expressed great regret at parting with him, because, he said, every evening when he went home the bird met him at the gate, and accompanying him on the walk to the house, told him all that had transpired during his absence. They *talk* in a low, soft and winning way as if desirous of communicating something in the utmost confidence.

These birds are not as habitually gregarious as the common goose, still two or more were generally found together, and frequently all four were found associated, and it was quite common to find one away by itself.

The foot is not more than half webbed, and it was rare that they stayed in the water more than a few minutes, and they did not visit the pond frequently, sometimes not taking a bath for weeks. They are not good swimmers. I once saw one with

the tail depressed in the water, and soaking wet like that of a hen when she is thrown into the pond.

I never saw them eat an ounce of food; they would sometimes pick a few crumbs of bread when thrown to them, but more frequently would drop them without swallowing. I never saw them eat grass or insects, or seek for food in the water. Indeed, what they live on has always been an unsatisfied question with me.

One pair of these birds was killed by a mink two years since. The male of the other pair disappeared last fall, and I could get no trace of him since; the goose passed a lonely winter. In the spring she made her way to the pig-stye and attached herself to a brood sow which occupied a separate pen; she never left her new-found friend for more than a few minutes at a time, and has never been known to go to the pond since, which is about one hundred yards distant. When the pigs were dropped, she seemed to take a great interest in the new family. But two survived. Of these she seemed to assume the entire charge by the time they were two weeks old. When she thought they needed an airing, she would drive them out of the pen on to the grass plat adjoining, and when they laid down together for a sun bath, she would get on to them and spread her wings over them as if to brood them. If a deer came near, she would chase it away with great resolution, and if a person approached, she would arouse her charge and drive them into the stye as quickly as possible. A small black-and-tan terrier is allowed to follow me into the park, and if he followed me up to the pen which adjoins the sty, she would go at him like a very fury, till he soon learned to avoid that neighborhood.

When the sow was removed and the pigs and the goose left in sole charge of the premises, she still continued in charge of the pigs, now grown to be good sized shoats, and so does she still, and they obey her orders without a moment's hesitation; indeed, most commendable discipline is maintained in that family.

I look upon this as a very remarkable case of unnatural attachment, and have been much interested in observing it. I have no doubt it will continue till the pigs go to the shambles. What will the goose do then? For the goose I can say that so long as she had a mate of her own species with whom she could associate, I never observed her to form any unnatural attachments. Why she did not seek consolation in her loneliness among some of the

other geese in the grounds, of which there are four distinct species, of course I cannot explain. We should certainly think it would have been more respectable and more natural. I hope the arrangements I have made will provide her associates of her own species, and if they arrive before the present attachment is broken off, I shall watch the effect with interest.

In former numbers of this journal have appeared accounts of unnatural attachments as extraordinary as those I have above described, but should I go beyond those within my own observation, I should not know where to stop, and could add nothing of value to my observations.

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BUTTERFLY HUNTING IN THE DESERT.

BY W. G. WRIGHT.

BEFORE the first whisk of daylight in the east we "pull out" for a trip of an hundred miles in the desert, on butterflies intent. The first twenty-two miles are a continual ascent, at first very easy, and later exceedingly steep, for this range of mountains bordering the fertile coast valleys of the three southern counties of California and separating them from the interior arid deserts, is, like all rocky and Andean ranges, precipitous on its western and gradual on its eastern slopes; so after we pass over the nearly level plain of the valley, the rise becomes more and more pronounced as we follow up the cañon forming the pass, and cross from side to side of its now meager run of water, through gullies, over ridges, around promontories and between cliffs, till on reaching the backbone of the range we find a formidable ascent of a thousand feet looming before us. Near here we pause to examine a cavity that was once a mammoth bee-hive; it is artificial, simply a bottle-shaped excavation in the solid rock some six feet in average diameter, and was intended for a cellar, but was closed up by a door and deserted when the settler's claim was eventually abandoned; then it was taken possession of by an ambitious skip of bees, and tons of honey stored in the cool recess, but the bees became so numerous and aggressive as to become a terror, and they were therefore exterminated by regular siege. The cabin of the settler still stands, and is used as a school-house, and the cool cave is appropriated by the children for a play house.

Here, also, at the foot of the steep ascent, is the last water of the day's journey, and as the next twenty-five miles must be made without water or rest, we halt here and take lunch and breathe the team.

The morning is now well advanced, and the sunshine is very warm in the close cañon; there should be butterflies about. Growing in the dry washes that furrow the mountain side are some Eriogonums with showy yellow blossoms, and feeding on these we see two yellow Argynnides, *A. callippe*, still in good feather at this late date (Sept. 11). Taking them to make sure that whatever ill success may betide, we will not return empty,and adding a few Pamphilas found about the water to keep them company, we resume the journey, climbing laboriously up the steep road, occasionally seeing a dark-brown Satyrus, but no other flying thing. At length the crest is reached, and with a parting glance behind us at the precipitous descent and the forest-covered mountain slopes, with the distant valleys and hills winking in the sunshine and the Pacific ocean glimmering in the background eighty miles away, we face the desert and see before us a vast extent of nearly level desolate plain, extending hundreds of miles, broken here and there by still more desolate, dry, rocky hills, sharp cones and volcanic peaks and upheavals of uncouth and indescribable shapes, all utterly desolate and barren, and without shrub or tree upon their forbidding sides. Mines galore, of copper, silver and gold, lie hidden in these rocky excrescences, but for other uses the whole region seems to be a world incomplete—not yet fitted for the abode of man. This, then, is the desert, with a new flora, a new fauna,lapped in an atmosphere robbed by occult causes of its last particle of moisture, and heated by a blazing sun, and avoided by everybody except gold hunters and other lunatics; is it not a promising field? We look forward over it with just a little fear, for several men of our acquaintance, and braver than we, have laid their bones to bleach in its sands.

Soon after passing the wind-swept crest of the pass, we see several *Satyrus boopis* settled, one in a place upon horse droppings; the insects rise as we approach, flutter off behind some bush, and alight upon the ground, but are wary, and only by cautious pursuit and a cast just as they resettle, can they be taken. Some miles further on a few Lemoinas are seen flitting about without any apparent object, and upon stopping they sometimes

come up to the horse and fly about his legs with great curiosity, and suffer capture thereby. At another place they are seen feeding on blossoms of *Eriogonum capitatum*, a few bunches of which are not yet quite dead. No more Lepidoptera are seen during the day's journey, indeed the paucity of animal life is remarkable; no squirrels except rarely a little white-tailed desert chipmunk, no birds except a few linnets, no flies, gnats or mosquitoes, no lizards or snakes, not even the ubiquitous rabbit. On account of the altitude at this place (5000 ft.), the temperature is not extreme and the winds are usually not hot, yet the sun shines with fervid power, and the reflection of its rays by the sand is still more oppressive, as no shade can be interposed. A thousand feet of descent tells, however, and by the time the river is reached the climate is rather torrid. Just at the close of the day, stopping for a moment to make collection of a plant, we see at a distance a large butterfly—a black Papilio—floating as only a Papilio can, over the low shrubs and within easy reach. To say that the net is seized and instant chase given, would be but a tame expression. A rapid pursuit, cautious approach, an alternation of hope, fear, anticipation, despair—a quick cast and he is mine! And as his strong wings beat vainly against the net, sending thrills of pitying exultation through the captor's fingers, the entomological mind is already exercised, ejaculating "Not Indra, for it has long tails; not Asteroides, for it has not yellow spots enough; not anything I ever saw; what can it be?" Vain looks in every direction for a mate are made, as with hands trembling with excitement the prize is stowed away, and then a glance at the now setting sun shows that it is time to be making camp. Going rapidly on down the dusty grade to the river, splashing noisily through its shallow waters, and then over the firm grassy sward between the large cottonwood and willow trees whose green shade is inexpressibly refreshing, a home for the night is quickly fixed upon and the tired and thirsty horse is freed from his harness and allowed to refresh himself as he pleases; while wood for the fire is obtained, supper cooked and eaten, and all the orthodox arrangements made for the night, before thick darkness shuts down; shuts up, I ought to say, for the darkness seems to rise from the ground and to thicken in the lower air, while above, the sky is not yet fully darkened, though the stars are coming out freely.

And as we sit about the camp-fire in the grateful coolness of gathering darkness, noting the subsidence of the breeze till perfect stillness surrounds us like a second atmosphere; utterly alone, yet desiring no other company, the soft-flowing swirl of the water invites us to think a moment about this strange stream upon whose banks we rest. Fifty miles from here it begins existence in springs high up among breezy pines and oaks and cedars on the range of mountains over which we have to-day come, and at an altitude that brings frost every month of the year, and dashing down dark cañons lined by alder and dogwood, at length emerges upon the desert and thenceforth knows only a sandy bed over a plain so level that its current is always gentle, changing and shifting over its sandy shallows from side to side forever. Large cottonwoods and willows line its banks or grow upon its damp islands throughout its entire course. In many places wide savannahs and islands of grassy margin feed herds of cattle. The size of the river is only that of a good-sized mill-stream, but though not a large river it is of a good deal of use, for, like Paddy's moon that shined in the night when there was no sun, this river waters a torrid desert where is no other water. A hundred miles of desert wandering, however, makes it tired of existence, and it gradually diminishes in volume, and after a while entirely sinks in the sand, afterward to reappear again, and thus it several times sinks and rises, till finally it sinks and is seen no more; the place of its final exit being laid down on the maps as "Sink of the Mojave," about 150 miles from its source.

As during all this fluviatile monologue no nocturnal Lepidoptera have come to visit our light, we can safely say the day is done, and we lie down and rest, for "God giveth his beloved sleep." Ere dawn, however, we hear a song: "Yap! yow yow yow!" 'Tis the melody of the lovely coyote. And the dogs of the near-by cattle ranch forthwith rush out with bays both loud and deep, and as the lupine sneaks retreat in one direction, they approach in another, but whether on the advance or retreat sleep is equally out of the question, and all the left-handed things we say of them do no good, so early rising becomes a relief, and before sunrise breakfast is over, and we stray about botanizing till the sun can warm the air and bring out the butterflies. Then, with net in hand, we walk the grassy banks, and beat the sandy mesa, but captures are limited. The

next stage of the journey is eighteen miles, when a watering place is reached, and it being the only water for thirty-six miles, and limited in quantity, it is sold like any other necessity. Not a lepidopterous insect is seen on the route or about this watering place. It is a most desolate and barren spot, no shade except the roof of the whisky-seller's cabin, no green thing about the spot except three little cottonwood trees planted at the horse trough, and all the wretched desert bushes look utterly dejected at the prospect of staying in that miserable place, and altogether it seems impossible to stay over night here, so another stage of eighteen miles is made.

This brings us to a mountain, the highest for many miles around. Upon its side, at an altitude of 7000 feet, is a gold mine, and this must be reached to get food and water for man and beast. The foot of the mountain is reached at dark, but the miles of steep ascent to the mine are so long and tiresome that it is late when at length the haven is reached. But the superintendent in charge has been long listening to the unwonted sound of wheels coming over the rocks in the still night; his little dog has come part way down to interview us, and as the expedition halts in front of the premises, tired out and done up, it is greeted with welcoming shout by the hospitable inmates, who, coming out, find a stranger and forthwith do take him in. And when the horse is fed, and when the expedition has washed a little dust from its face and hands and begins to feel a little more like a man than a bundle of dusty bones, the superintendent turns to his cook—"Bring on the doves—let 'em fly!" And two dozen fat doves sail in from the kitchen, done up in a generous hot stew, with potatoes and onions and tomatoes, and with all the other accompaniments, flanked by fresh bread, strong tea, honey white as water, and such a lot of other fixin's that the butterfly-hunter concludes that entomology is a good pursuit if it brings him to such hospitality as this. And when at length the visitor's hunger and thirst are appeased, and the host's thirst for news is in part satisfied in return, the stranger is shown to his bed-place (for the traveler in these regions always takes his bed along with him), the bed-place in this case being a cosy corner of the room, on the ground floor, no other floor of any kind being allowed on the premises, and given good-night salutation—"To bed, to bed, to sleep" and the guest replies—"To sleep, perchance to dream;" and sleep comes, so sound and

so restful that even the flutter of a moth on the window would not be heard. In the morning, after breakfast, we all go to see the dove-trap. It is an old mining tunnel that serves as a drain, but in times like the present the stream of water gradually diminishes till it at length runs not out of the tunnel at all, but inside in the darkness there is always water; and the wild doves have learned to follow up the shortening stream as day by day it flows less and less further out, until they fly into the dark tunnel for it, as it is the only water for many miles, and are there caught in nets. But as for insects, none are seen about here, although there are damp spots well suited to their use, so that here where we hoped to capture fine things our nets are idle and our boxes full of emptiness.

So we ask and receive instructions as to the route for the next point, and receive them with the comforting assurance that if we go to the right, it is forty miles to water; if to the left, it is as far; and that if we fail to turn to the east at the proper place, near the two volcanic peaks, we shall go utterly astray, and the only way to save our horse's life would be to retrace our own track. But on we go: ten miles out we see a lone Lemonias sitting in grief on a dry stick; we had no wish to relieve him in his misery, but left him for seed; it was the only butterfly seen during the day.

In due time the tracks to the right and to the left are passed; the two black volcanic peaks are recognized and left behind, and a long, weary descent of many miles made into a low-lying basin, near some mountains at present quiet enough, yet which were once alive with volcanic fires, and here, in one of the warmest spots we ever saw, our camp for the night is to be. The air is marvelously mellow and soft, from what local cause we know not, for our advent was after sundown, but at any rate, the people habitually sleep "out in the open," as they call it, and generally without other cover than that so freely given by darkness. As for the expedition, it searched out a spot as far removed as possible from prowling visits of individuals of the genus Sus, which are the most intolerable nuisances about a camp within bounds of civilization; cooking a little tea with dry mesquite twigs, we ate supper in the darkness, and then spreading the bedding on the warm sand, kicked off all covering, knowing no more trouble or fatigue until dawn brought forth a bright new day. An early start sends us on the way across the bed of a dry lake, whose floor is as hard

and smooth as plank, and the ringing tramp of the horse's hoofs make merry music after so long a toiling over sandy waste, while those few miles are so quickly sped that it is discussed whether it will not be best to retrace them, and so get another ten miles of good road, but the motion is lost by a majority of one. To console the minority for its defeat, a pretty Terias is seen speeding its rapid, erratic flight over the bushes and defying capture, as it never alights. The day passes as do all days of desert travel, in tiresome dragging through sandy wastes and over dusty hills, and with tedious straining of the eyes to catch the first possible glimpse, though miles away, of the green tree tops of the oasis, where is to be the night's camping-place. And when in due time our weary feet step upon the soft, green grass of the river side, the feeling of relief from a straining anxiety and of comfort as if at home, is inexpressible, and we set about the work of camp-making with light hearts and with joyous songs. The grove rings with our badinage and we imagine that the cottonwoods clap their leaves in applause at our jokes. Here, with this day's journey, our expedition reaches its objective point, and the journal thereof finds its legitimate conclusion. And here on an oasis, in the middle of the dreaded desert, we raise our hat and take leave of its sandy majesty with great respect, for forbidding and perilous as it is, it has compensating charms. If our noses have been skinned by its burning heats, two-edged appetites repay us for the loss of epidermis, and the fear of its terrors is counterbalanced by the satisfaction of having overcome them. We leave it, thankful for our lives, yet with regret, for we feel its attractions, and we begin to understand the delight of the Arab in his desert, and the attachment that leads captive any man for a pursuit in itself perilous; while to fitly crown the whole, we find that our travels have not been in vain, for examination shows that we have accumulated several nice things; one of which, a new Copæodes, is published contemporaneously herewith; also a supply of another prize, *Ancyloxypha libya* Scud., and other treasures that to the butterfly hunter are treasures indeed.

THE EXTINCT RODENTIA OF NORTH AMERICA.

BY PROFESSOR E. D. COPE.

(Continued from page 174.)

Pliocene and Post-pliocene Rodentia.

Castoroides Foster.

The only known species of this genus, the *C. ohioensis* Fost., is the largest of the order. It is found in the post-glacial deposits with the *Mastodon ohioticus*, in rather limited numbers.

Mr. J. A. Allen, of Cambridge, has studied the affinities of this genus, and states them as follows: "Castoroides presents a sin-

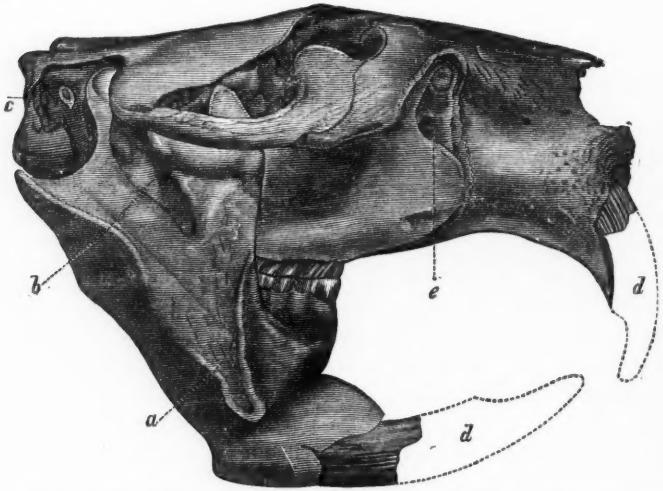

Fig. 22.—*Castoroides ohioensis* Fost., two-fifths natural size. *a*, Inferior limit of attachment of masseter muscle; *b*, Deep fossa below sigmoid notch of mandible; *c*, External auditory meatus; *d*, Superior and inferior incisors; *e*, Foramen infraorbitale. From Hall and Wyman.

gular combination of characters, allying it, on the one hand, to the beaver, and, on the other, to the chinchillas and Viscachas and also to the muskrat, but which at the same time separate it widely from either group."

"The molars differ strikingly in structure not only from those of Castor, but from those of all other rodents except the Chin-

chillidæ, a near resemblance being met with elsewhere only in the last molar of the Capybara. They consist of a series of laminæ of dentine completely inclosed by enamel, held together by a thin coating of cement. The circumference of the triturating surface of the tooth is thus devoid of the continuous plate of enamel that forms an uninterrupted border in the molar teeth of ordinary rodents, and is deeply serrated. The dentinal laminæ, with their

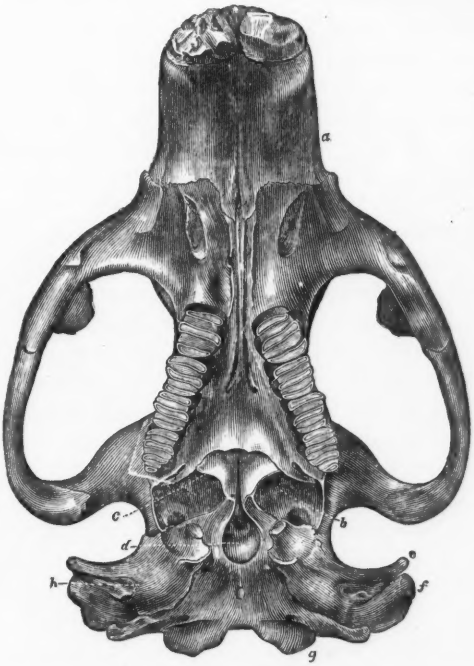

FIG. 23.—*Castoroides ohioensis* Fost., two fifths nat. size. *a*, Incisive foramen; *b*, Pterygoid fossa; *c*, Internal pterygoid plates; *d*, Fossa in basioccipital; *e*, External auditory meatus; *f*, Mastoid process; *g*, Condyles; *h*, Tympanic bulla. After Hall and Wyman.

inclosing plate of enamel, are three in number in all the molars, except the last upper and first lower, which have each four. When the teeth are exposed to disintegrating influences, the laminæ of dentine and enamel readily fall apart, as is the case in the molars of the Chinchillidæ, in the last molar of the Hydrochærus, and in the molars of the elephant. In structure the

molar teeth of Castoroides are strictly comparable with those of the Chinchillidæ, and with the posterior portion of the last molar of Hydrochærus, and thereby differ not only radically from that seen in Castor, but from that of all other rodents.

"The resemblance of Castoroides to Castor is mainly in the general outline of the skull, in its having an imperforate anteorbital wall, and in its presenting a similar curvature of the descending ramus of the lower jaw, the latter a character shared also by Fiber. The differences consist in the remarkable structure of the pterygoid processes, the double orifices of the posterior nares being entirely exceptional; in the flattened and relatively small cranium, and in the compound nature of the molar teeth. These differences ally it on the one hand to the Chinchillas, from which it differs mainly through those points in which it resembles Castor. In view of these wide differences from its nearest well-known allies, it seems to constitute the type of a distinct and hitherto unrecognized family. To the same group are, however, probably referable the genus Amblyrhiza, described by Professor Cope, from the bone caverns of Anguilla island, West Indies. These forms are thus far known only from the detached teeth and fragments of the limbs. The molars as described and figured by Professor Cope, greatly resemble those of Castoroides, having in fact the same structure, differing mainly in being somewhat smaller, and in possessing a greater number of laminæ. (There are also other differences, see below under Amblyrhiza.)

"The *Castoroides ohioensis* was of about the size of a full-grown common black bear (*Ursus americanus*), hence somewhat exceeding in size the Capybara, the largest of existing rodents. A cast of a skull has a length of over twelve inches. The species being known only from a few cranial and dental remains, it is impossible to say much respecting its general form or probable habits. It may have been aquatic like the beaver; but of this there is no evidence. The form of the occipital condyles and the surfaces for the attachment of the cranial muscles show that it probably differed greatly in habits from the beaver."

The sculpture of the incisor teeth of this species is elegant, and distinguishes it readily from all other Rodentia.

SCIURIDÆ.

Squirrels were probably abundant during the latest Tertiary

periods in the United States. I have described a true squirrel, *Sciurus panolius*, and a chipmunk, *Tamias lævidens*, from Virginian cave deposits, and have found indisputable remains of the ground marmot, *Arctomys monax*, associated with them. In the Port Kennedy bone cave in Pennsylvania, Mr. Wheatley found *Sciurus calycinus* Cope, associated with Megalonyx, etc.

Remains of the beaver are common in the latest Tertiary beds.

MURIDÆ.

Jaws undistinguishable from those of the jumping mouse, *Meriones hudsonius*, were found in the Port Kennedy bone cave. A large wood-rat, *Neotoma magister*, was found by Professor Baird in the Carlisle, Pa., bone cave. The meadow-mice (Arvicola), left numerous remains in the Port Kennedy cave, which represent no less than six species.[1] Four of these are related to the

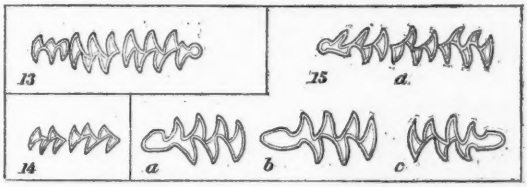

FIG. 24.—Diagrams of molar teeth of Arvicola, from the Port Kennedy bone cave, Pennsylvania, enlarged. No. 13, *A. speothen* Cope; No. 14, *A. tetradelta* Cope; No. 15, *A. didelta* Cope. From Proc. Am. Philos. Soc. 1870.

recent smaller meadow-mouse, *Arvicola pinetorum;* while two, the *A. speothen* and *A. hiatidens* Cope, represent special divisions of the genus. These I have called Isodelta and Anaptogonia respectively. The *A. hiatidens* is one of the largest species of the genus, and the columns of the first inferior molar are more numerous than in the species found with it. The inflected angles between the columns do not touch the sides of the opposite columns as in most species of the genus. Arvicolas also occur in the Pliocene of Fossil lake, Oregon.

SACCOMYIDÆ.

I found an almost perfect skeleton of a "gopher" in the won-

[1] See Proceedings American Philosophical Society, 1871, p. 87.

derful bone deposit known as "fossil lake" in the Oregon desert. I cannot distinguish it from that of the *Thomomys bulbivorus*, now living on the borders of that region.

Professor B. F. Mudge discovered the skull of a large species of the genus Geomys in the sands of the Blue river, Kansas, which I cannot distinguish from a living form.

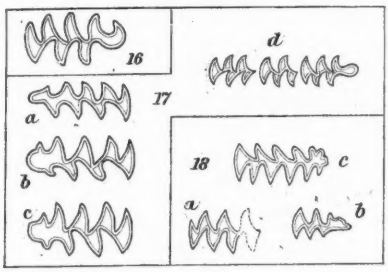

FIG. 25.—Diagrams of molars of Arvicolæ, from the bone cave at Port Kennedy, Penna., enlarged. No. 16, *A. involuta* Cope; No. 17, *A. sigmodus* Cope; No. 18 *A. hiatidens* Cope. From Proceed. Am. Philos. Soc. 1870.

AMBLYRHIZA Cope.

This remarkable genus of rodents was first detected by me as found in the West Indian island of Anguilla. I have since seen molars of a species of the genus in a collection in Charleston, South Carolina, showing that it extended its range to the continent, and must be included in our Pliocene fauna.

In the year 1868 a quantity of cave earth, limestone fragments and bone breccia were brought to the port of Philadelphia from a cave in the small Antillean island of Anguilla, which belongs to Denmark. Through the attention of Mr. Waters I learned of the existence of fossil bones in the cargo, and proceeded to examine them. Remains of long bones lying irregularly in a rather hard but cavernous red cave deposit of limestone, were found mingled with fragments of lighter limestone from the walls of the cave in irregular masses, the whole being penetrated and mixed with a yellow stalagmitic deposit of arragonite.

From a block of the breccia I dressed three molar teeth, two partially complete, and two much broken incisors, fragments of maxillary and pelvic bones, shafts of various long bones, and the

distal extremity of a femur with a patella. These were the first evidences of the existence of the large rodent *Amblyrhiza inundata*, which was described in the Proceedings of the American Philosophical Society for 1868. Other bones were found in other breccia masses, which I could not clearly refer to any other animal. With them occurred a shell of *Turbo pica.*

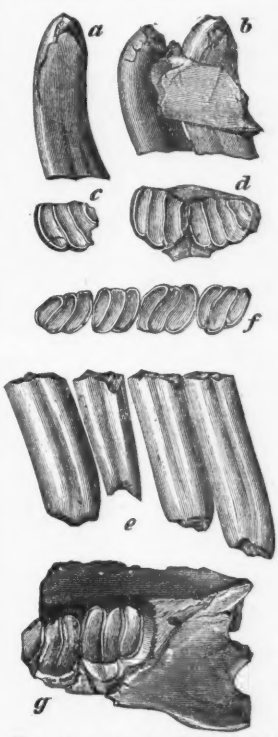

FIG. 26. — Teeth of Amblyrhiza, from Anguilla, two-thirds natural size. Original. Figs. *a–b*, *Amblyrhiza inundata* Cope, superior molars, lateral view; *c–d*, from below. Fig. *e*, inferior molars, lateral view; *f*, from above. Fig. *g*, posterior part of mandible of *A. latidens* Cope, showing molar and lateral coronoid process.

Having learned that Dr. E. van Rigjersma, colonial physician of the Danish island of Saint Martins, was interested in the natural sciences, I wrote, asking him to make an examination of the deposit in question, and to secure, if possible, all fossils discovered in excavating it. He accordingly very kindly went to Anguilla and was rewarded by the possession of numerous additional teeth and bones of Amblyrhiza. Subsequent visits added two species of this genus, together with the bones of a species of ruminant of uncertain genus; bones of a probable rodent of smaller size of two species of birds, of a lizard, and a shell chisel of human manufacture.

The three species are *A. inundata*,[1] *A. quadrans* and *A. latidens* Cope. The first named is the smallest species, and the teeth from Charleston are perhaps referable to it. All the species agree in presenting the following characters:

The premaxillary bones and the symphysis mandibuli are much produced and narrowed, and were probably enclosed in fur-bearing integument, as in the existing Chinchillas. The

[1] The *Loxomylus longidens* was probably based on inferior molars of this or of a nearly allied species.

mandibular rami are completely coössified. They are united at their lower borders posterior to the divergence of their dental ridges, by the expansion of the stout rib of their inner face which encloses the incisive alveolus.

FIG. 27.—Jaws of *Amblyrhiza latidens* Cope, two-thirds nat. size, from Anguilla, W. I. Original. Fig. *a*, superior incisors from above; *b*, lateral view; Fig. *c*, inferior incisors from below; *d*, do. from above, with symphysis.

The dental formula is I. $\frac{1}{1}$; C. $\frac{0}{0}$; M. $\frac{4}{4}$. The incisors have a moderately thick enamel layer which is wrapped round the external angle a short distance. Their sculpture is not deeply cut. The molars are composed of vertical columns of dentine enclosed in and separated by laminæ of enamel. The columns are more or less transverse, and are neither confluent nor divided in any of the teeth. They number four in the superior teeth, excepting in the last molar where there are five. The entire tooth is enclosed in a thin layer of cement. The superior molars are curved bow-shaped, the convexity being directed forwards at the middle of their length. The enamel plates are then directed backwards on the grinding faces. The extremities of the roots are simple and contracted to an obtuse termination. The inferior molars differ in their form, being straight and directed obliquely forwards in the jaw. From this it results that their triturating surfaces are oblique to the axis of the teeth, while those of the superior mo-

lars are transverse to the axis of the middle portion of the shaft. There are but three columns in all of the inferior molars.

The only caudal vertebra preserved is short and wide, has short diapophyses, and no facets for chevron bones. As there is no trace of neurapophyses on the centrum, I infer that the tail is short.

The fore-limb is of smalier proportions than the posterior one.

The humeral condyles have the ulnar and radial portions about equal, and the intertrochlear ridge is represented by an obscure angle. Both ulna and radius are slender.

FIG. 28. — Proximal portion of femur of *Amblyrhiza latidens*, two-thirds natural size. From Anguilla, W. I. Original.

The femur has several marked peculiarities. One of these is the great development of the great trochanter, which is really an undiminished continuation of the shaft for some distance beyond the head. The head is relatively small.

The distal extremity of the tibia is expanded inwards. The astragalar facets are oblique; the external is larger than the internal, and they are well separated by an obtuse ridge. There are two processes on the internal border, which are separated by a deep tendinous groove, which is, in most of the specimens, bridged over by a lamina connecting the processes. The posterior of the two processes is the most elongate. It corresponds to a process of the astragalus which extends backwards and inwards from the internal trochlear face. When extension of the foot is attempted, the processes come into contact, and prevent further movement. The amount of extension from the horizontal which this arrangement permits is 45°. When the foot is extended the processes constitute a support to the weight of the animal in addition to that furnished by the usual astragalar facets.

The metatarsal bones are distinct from each other and are quite short. There were certainly four toes, and the hallux may have been rudimentary. The foot was clearly plantigrade. Whether the digits terminate in hoofs or claws, is unknown.

The lack of tibial crest indicates that the knee was not constantly maintained in a flexed position. The immense trochanter indi-

cates great power of extension of the femur, but whether this extension was effective in running or kicking is uncertain. The absence of tibial crest, and the shortness of the foot militate against the supposition that these animals possessed powers of leaping, and their swimming powers would be impaired by the same structural characters. These characters of the posterior limb in Amblyrhiza are very peculiar, and are no doubt connected with some peculiarity of habits which we have yet to ascertain.

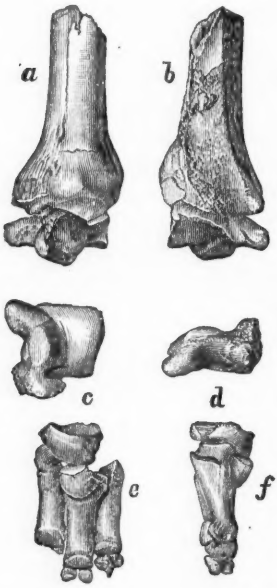

FIG. 29.—Posterior foot of Amblyrhiza, two thirds nat. size. Fig. *a*, tibio-tarsal articulation of *A. latidens* from front; *b*, from behind; *c*, astragalus of do, from above; *d*, from external side; *e*, second row of tarsal bones with three metatarsals of *A. inundata* from front; *f*, from inner side. From Anguilla. Original.

This genus clearly enters Professor Brandt's division of the Rodentia, which he terms the Hystricomorpha. The evidence is seen primarily in the free fibula and in the development of the angular portion of the mandible on the external side of the incisive alveoli; the small coronoid process and the generic characters add to the weight of the evidence. Mr. E. R. Alston has recently published a very valuable resumé of the characters of the subdivisions, including the genera of the Rodentia. He divides the Hystricomorpha into numerous families, some of which, at least, appear to the writer to rest on rather slender bases. In the comparison with Amblyrhiza, the Hystricidæ and Dasyproctidæ may be dismissed, from the fact that their molars are not divided transversely by laminæ of enamel. The comparison is with the Chinchillidæ and Caviidæ. The molar dentition is that of the former family, but the absence of a masseteric ridge separates it from the genera arranged by Mr. Alston under the Caviidæ, although I cannot perceive that such a character should define a family group. The incisors of both these groups are called by Mr. Alston "short." I have shown those of Ambly-

rhiza to be very long, as in the Dasyproctidæ; nevertheless their transverse section and sculpture are much as in the genus Lagidium. The affinities of this form are, then, near to types now existing on the South American continent, but it presents characters which show that it cannot be referred to any existing genus.

The *Amblyrhiza inundata* may be described as frequently supporting itself on its hinder legs, with the entire hinder foot applied to the ground, and its smaller fore-legs hanging by its side. Its general bulk could not have been less than that of a doe Virginian deer. What its habits could have been, cannot readily be inferred, but its food was doubtless of the general vegetable character of other members of the order. The *A. latidens* must have been larger than the male Virginian deer.

HYDROCHŒRUS Briss.

The only existing species of this genus, the Capybara, is the largest of Rodentia living, and is confined to South America. Leidy has described a species from the Ashley river deposits near Charleston, South Carolina, under the name of *H. æsopi.* Its teeth, the only portions known, are similar to those of the Capybara, but according to Leidy, the inferior incisor tooth is more strongly ridged than in the living species.

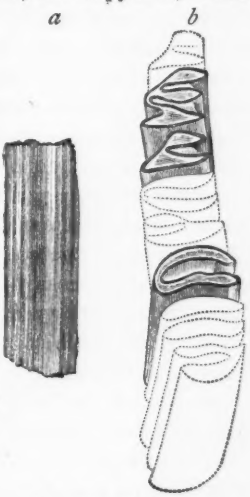

FIG. 30.—Teeth of *Hydrochœrus æsopi* Leidy, nat. size. From Charleston, S. C. After Leidy. *a*, fragment of superior incisor; *b*, the shaded portions represent parts of inferior molars found.

ERITHIZON F. Cuv.

The existing American porcupine was represented in the Megalonyx beds by a species, the *E. cloacinum* Cope, of which a single tooth was found in the Port Kennedy bone cave.

LAGOMORPHA.

A rabbit-like animal, probably of the genus Lagomys, was found in the Port Kennedy bone cave. It is rather larger than the *Lagomys princeps* of the Sierra Nevada. It is of interest, because no species now inhabits the eastern part of the American continent. I have called it *Lagomys palatinus.*

The Development of the Rodentia.

The Rodentia, like other divisions of Mammalia, present a succession of changes of structure in time, in the feet and in the teeth. The earliest known forms, as above pointed out, are the allies of the squirrels, members of the sub-order Sciuromorpha. These have the most generalized foot structure because: first, the trochlear structures of the humerus and tibia are not at all or but little developed; second, because they have five digits on the feet, and are plantigrade; and third, because the fibula is not coössified with the tibia. They are similarly primitive in the forms of the teeth, because they are rarely prismatic, and nearly always have long roots and short crowns. The cavy division, or sub-order Hystricomorpha, must claim the next place, but many of its members show a decided advance in having a limited number of toes, and prismatic dentition. In the third sub-order, Myomorpha, the mice, etc., we first meet with the coössification of the fibula with the tibia. A good many genera have prismatic teeth, and some of them a restricted number of digits; and a few of them (the jerboas) even metatarsal bones coössified into a cannon bone. The rabbits have the most specialized characters in all the points mentioned, but they add another character which is most primitive, viz., the presence of four superior incisor teeth. This is probably a remnant of the primitive group from which all the Rodentia have been derived. By the law of homologous groups it is not probable that the divisions of Rodentia were descended from each other, but from corresponding groups of the primary order from which they were derived as a whole. This division may have been the sub-order Tillodonta of the Eocenes, or the Rodentia may be the descendants of the Marsupialia with or without the intervention of that group.

The differentiation of the sub-orders of the Rodentia evidently dates from a period at least as early as the lowest Miocene. It is an important fact that the Lower Eocene (Wasatch epoch) has as yet produced nothing but the lowest type (Sciuromorpha). It is also true that the Puerco Eocene epoch has, in sixty species of Mammalia, disclosed no Rodentia at all, while Tillodonta and Tæniodonta are abundant.

The Myomorpha first appear in the White River beds (Oligocene), but none with prismatic teeth occur below the John Day epoch. The Lagomorpha, on the other hand, present us with

almost all their special characters at once, in the White river. The Hystricomorpha, whose home is in South America, are unknown in North America below the Loup Fork or highest Miocene, where Leidy identified a true porcupine, *Hystrix venustus.*

Many of the extinct genera stand in evident genetic connection with existing forms. The Miocene Castors doubtless include the ancestor of the modern beaver. The Ischyromys is a primitive type of the Sciuridæ, and Gymnoptychus connects it directly with the existing forms by the character of its molar teeth. Eumys is the primitive form of Hesperomys, as Paciculus is of Sigmodon. Entoptychus and Pleurolicus are the near ancestors of the Geomyidæ of the Pliocene and present periods. Palæolagus, Panolax and Lepus form a direct genetic line. The ancient genera all differ from their modern representatives in the same way; that is, in the greater constriction of the skull just posterior to the orbits and accompanying absence of postorbital processes. This relation may be displayed in tabular form, as follows:

Skull wider behind orbits.		Skull narrower behind orbits.	
Postorbital processes.	No postorbital processes.	Postorbital processes.	No postorbital processes.
.....	Castor fiber.	.....	Castor peninsulatus.
Sciurus.	.....	.....	Ischyromys.
.....	Hesperomys.	.....	Eumys.
Lepus.	.....	.....	Paleolagus.

None of the species of this fauna are of larger size than their modern representatives. In the cases of the beaver, squirrels and rabbits, the ancient species are the smaller.[1]

——:o:——

HETEROGENETIC DEVELOPMENT IN DIAPTOMUS.

BY C. L. HERRICK.

IN a paper in the Report of the Geological and Natural History Survey of Minnesota, the writer suggested that this genus is unusually affected by changes in the environment, and an example is given in the case of *D. castor.* The form called *giganteus* was shown to be probably an enlarged variety of the above. In a paper in the NATURALIST this matter was expanded and an attempt made to parallelize the two forms with the two

[1] For these conclusions see Bulletin U. S. Geolog. Survey Terrs., VI, 1881, 362–3.

stages in adult Cyclopidæ. I am now able to set the matter at rest with reference to these two forms at least. Having had occasion to collect fresh-water animals through the entire length of the Mississippi valley from Lake Superior to the Gulf of Mexico, many hundreds of specimens of Diaptomus have been examined in the most diverse localities. If it were permissible to establish a species upon slight variations in structure, numbers of them might be distinguished. However the following facts debar me from attempting it: At Decatur, Ky., a series of small pools in various stages of stagnation, furnished an opportunity for studying the variations due to age and conditions of the water.

It is remarkable that in such small bodies of water only one stage may be present in one, while the next, a few feet away, may offer another.

In the same localities the various stages of a Phyllopod could be studied in the same way.

The normal *D. castor*, like Minnesota specimens in its various stages, occurs in some pools, in others, a few steps away, occurred a larger form, at a glance distinguishable from the above by the short antennæ and stylets, and the structure of the fifth feet. I was, however, struck by the fact that all these specimens were immature (though nearly as large as *D. giganteus*), and unaccompanied by the adult stages. Figs. 1, 2, 3 and 9, Plate V, show some of the peculiarities of the normal *D. castor*; 1*a* and 9*b* show the effect of senility on fifth feet and antennæ. Figs 4, 5, 6 and 9 show the corresponding parts in the enlarged form.

Further study showed me that the difference distinguishing the second from the first forms, saving the compact build of the former, are just those found in young of *castor*. It then only remained to find the specimens in the process of molting with the combined characters of both (Fig. 8) to convince one that the enlarged form is really identical with *castor*, but by favorable circumstances enormously developed.

Differentiation takes place before the mature stage is reached, in the same way that tadpoles wintered over are greatly enlarged.

I have found the typical *D. sanguineus* of Forbes in Alabama. This form has some peculiarities to distinguish it from the common var. of *D. castor*.

In view of the facts now known regarding the development of Diaptomus, we may safely say that *D. stagnalis* Forbes, is an en-

larged variety or age form of *D. sanguincus*, but the writer must still express his decided belief that these must all be referred to the European *D. castor*.

It must be admitted that the intensity of coloration does not depend upon season but upon the conditions of the water which may or may not be influenced by the time of year. In the same month I have found the same species of all colors, from colorless to deep crimson-red or variegated red, yellow and blue or purple. Weissmann seems to have neglected these facts in referring the coloration of many species of Cladocera to sexual selection. I have found in every case where the Diaptomus was intensely red, the species of Cyclops, usually green or bluish, would be more or less red also. In Swan lake, near Decatur, nearly all the Cladocera were brilliantly marked, *sida* and *simocephalus (?)* being most so; in the neighboring lakes these species were pale as usual.

With respect to the identity of our species. 1st. The armature of the last segment of thorax is usually obscured by doubling over. Fig. 12, Plate VI of Brady gives the large thorn but omits the lower process. 2d. Fig. 7, Plate VI of Brady figures the process on the antenna of male. (Claus gives the best figures.) 3d. Fig. 5, Plate I of Cyclopidæ of Minn., Herrick shows that the inner branch of the male fifth foot is armed by three spines (as figured by Brady) in Minnesota specimens. It must be remarked that this applies to young forms only, and that the later forms lose them and become shorter. Brady has probably transposed his numbers as regards the female feet of fifth pair.

The serrature of the spines differs between different age forms.

Diaptomus pallidus Herrick (Plate VII, Figs. 1–6) is quite rare as compared with the foregoing. The peculiarities mentioned in the original notice suffice to distinguish it from any other known to me. *D. sicilis* Forbes, seems to sustain the same relation to *pallidus* that *giganteus* does to *castor*. The two-jointed character of the inner branch of female feet in *sicilis* confirms this view. There are several differences however.

Char. spec.—Extremely slender; head separate from thorax by a suture; antennæ longer than the caudal setæ; setæ very long; fifth foot of female very short, inner branch with only one terminal seta at end; the male fifth feet long; the jaw is like that of *castor*.

Diaptomus leptodus has not been recognized in the South. Fig. 4 of Plate VIII in the NATURALIST, July, 1882, represents the process or inner branch of fifth foot reversed, probably by pressure; Fig. 6 of the same plate omits one of the setæ on the last joint. Now comparing these figures with others, we see less difference than as given.

EPISCHURA FLUVIATILIS, sp. nov. (Figs. 10–20, Plate V).

The genus Epischura, which was founded by S. A. Forbes[1] upon a species of Copepod, *E. lacustris*, inhabiting Lake Michigan, is one of the most interesting as well as anomalous of the genera of Calanidæ. The typical family likeness is preserved, but there are several peculiarities which have no parallel in Copepoda, if elsewhere.

The animal for which the name *Epischura fluviatilis* is proposed, is undoubtedly extremely near the above, but in several respects disagrees with the points in Forbes' description which he seems to rely upon as of generic importance. It might be assumed that these differences have generic value, and I should be inclined to so regard them except that there seems a possibility that Mr. Forbes has slightly mistaken the homologies of the anomalous organs as indicated below.

As no generic characters were given, this second species may warrant an attempt, as follows:

EPISCHURA Forbes, 1882.

Char. gen.—Cephalothorax slender, 5–6-jointed; abdomen 4-jointed in male. 3-jointed in female; second antennæ as in Diaptomus; mandibular palp biramose; swimming feet all biramose; inner ramus 1-jointed; left foot of last pair aborted or obsolete, right foot in female slender, last feet of male greatly modified (right?), foot biramose, inner ramus short, lamellate, 1-jointed with claw-like setæ, outer branch nearly like female, left foot coalesced with the first two joints of abdomen, extremity alone free; setæ of caudal stylets three.

Forbes says of *E. lacustris* that the female has a process upon the abdomen and in both sexes the latter is curved and deformed. In *E. fluviatilis* the abdomen of the female appeared normal, 3-jointed, and differs in no way from Diaptomus except as to the number of setæ. It is to be remarked that Epischura offers an extreme example of the tendency noticed in all Copepods, as well as frequently in higher Crustacea, to diminish or abort the inner branch of biramose organs on either side the median line.

[1] S. A. Forbes. On some Entomostraca of Lake Michigan. AM. NATURALIST, July, 1882.

This may be observed in the abdominal feet of Palæmon, the mouth parts of Cyclopidæ, but extends to the first pair of swimming feet in Diaptomus, and in this case involves all of them. The advantage of this arrangement, as well as its cause in the law of adaptation, is evident in the case of such animals as rely much upon a current below the body for food or the aeration of the blood. In Epischura the antennules rotate and create such a current past the mouth as is seen in other Copepods.

Char. spec.—Cephalothorax imperfectly 6-jointed; antennæ 25-jointed, in the male 6 joints follow the hinge, the enlarged portion is not greatly thickened, the antennæ reach somewhat beyond the thorax; mandibles with about nine teeth, the first of which is large and divaricate, more or fewer of the following ones are emarginate; mandibular palp biramose, inner branch 1-jointed, outer branch 3-jointed; maxillipeds not unlike Diaptomus but shorter and more strongly armed with curved spines; (last feet of female 1-branched with a straight claw terminating the distal segments, or) left foot obsolete and the other 2-branched, each branch 3-jointed, the right male foot of last pair is much more modified, its inner ramus is lamellate and curved in upon itself so as to make a grasping organ of curious form, in this office it is aided by two or more curved movable hooks which may probably be regarded as modified setæ, the second joint of the abdomen bears on its left side an appendage of two joints, the basal joint being flat and extending into a strong curved claw reaching to the base of the furca, while the second is slender and has two small setæ at the end, thus is formed a powerful hand.

I regard this appendage as perhaps the terminal joint of the left of the last pair of feet; indeed there seems to be some internal connection with the last thoracic segment, although externally none remains, the abdomen is otherwise quite normal and straight.

These suggestions with regard to the homologies of the organ are offered with some hesitation, as such a coalescing of a limb with the abdomen has never been described. However I believe the same thing takes place, though to a less degree, in Cyclops. In *C. mulleri*, for example, the fifth foot entirely disappears, leaving only two separate spines to indicate its position. It is suggested that certain spines adorning the first segment of the abdomen in most species of Cyclops may be rudiments of the missing second ramus of the fifth foot. By comparing Figs. 11 and 12 of Plate V with 1 and 3, representing the corresponding parts in Diaptomus. it will be seen that the theory advanced places all the parts in the place demanded by the schema of the limbs in Calanidæ.

Comparing the fifth leg of the female, Figs. 12–13, with the preceding one, Fig. 20, it appears to correspond with one leg only,

but both rami are 3-jointed as in the swimming legs of other Calanidæ. On the other hand, regarding both legs as present, the "hand" of the male does not homologize with the left limb, and we have besides to account for a supernumerary 2-jointed limb on the *second joint of the abdomen*..

The present species was found in large numbers in Mulberry creek, Cullman county, Alabama; the color is bluish-green, and the length about $\frac{4}{100}$ in.

ENTOZOIC PARASITES IN ENTOMOSTRACA (Fig. 15, Pl. VI).

We have discussed the relation of the minute fresh-water Crustacea to sanitary science in a paragraph in a recent article in the NATURALIST, but it remains to touch upon another phase of the subject. It may be thought unnecessary to trouble ourselves about the pathological conditions prevailing among such lowly animals, but it can be shown that these same causes of disease may not be unimportant in connection with human diseases.

It is a fact constantly receiving new exemplification, that the parasites infesting small animals, particularly water animals, are frequently but the immature forms of parasites of animals higher in the scales. These alterating generations are exceedingly difficult to study, so that while all stages may be separately known, only a fortunate combination of circumstances or patient accumulation of facts can connect the individual factors into the complete cyclus.

Thus, for example, Professor Leuckart has but recently worked out the full life-history of *Distomum hepaticum*, although the adult has been a stock example in helminthological study in the laboratory for years.

The importance of such parasites, even in a commercial view, needs but a reference to trichinosis to illustrate. I am not aware that endo-parasites are known in Entomostraca except in the case of Cyclops. Embryos of *Cucullanus elegans*, a nematoid worm, enter the body-cavity of Cyclops and undergo two molts and then are transferred to the intestinal canal of food-fishes.[1]

Taken in connection with the recent discoveries of S. A. Forbes,[2] showing how dependent our own food-fishes are upon

[1] Claus. Kleines Lehrbuch d. Zoologie, p. 368.

[2] Forbes. On some Entomostraca of Lake Michigan, AM. NATURALIST, July 1882.

Cf. Ryder on Food Fishes, Bul. U. S. Fish. Com.

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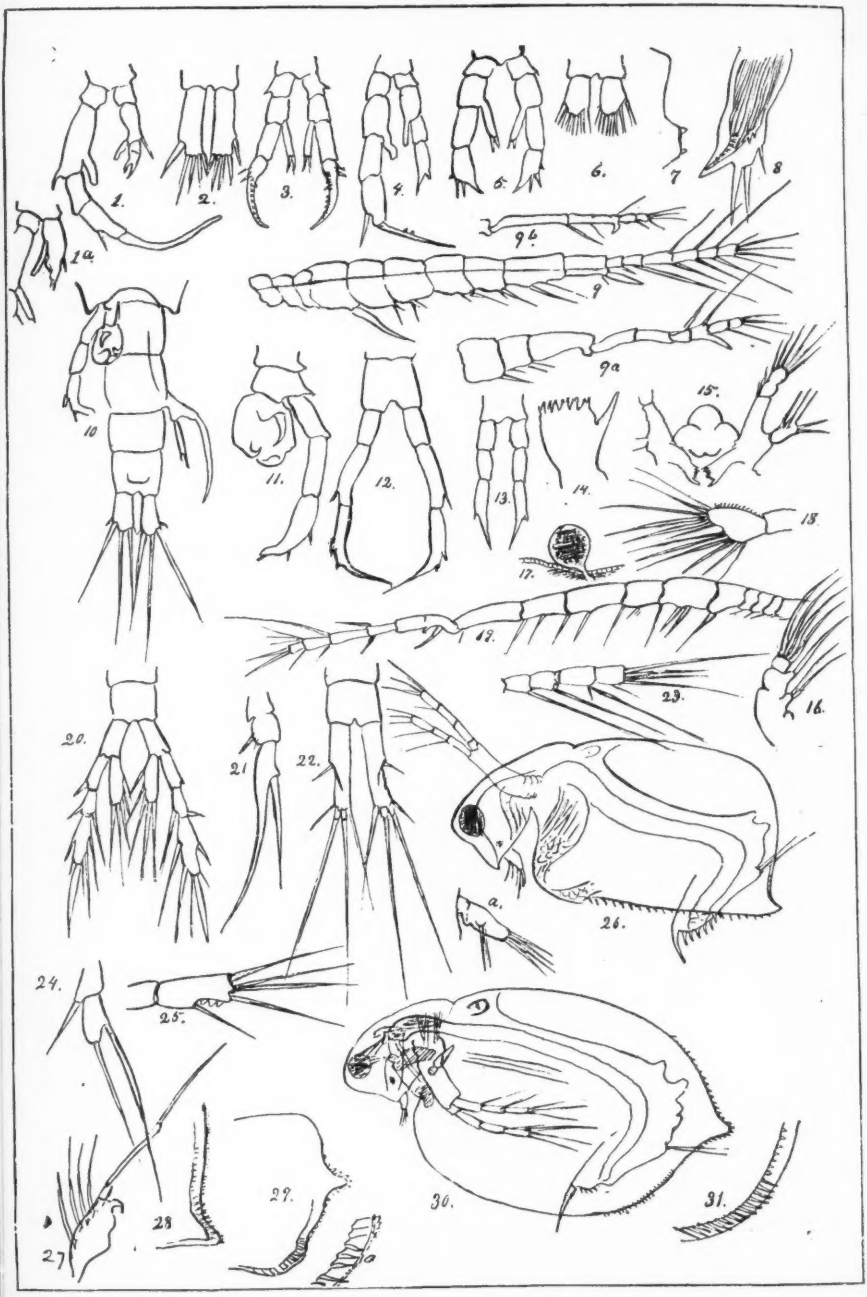
PLATE V.



FRESH-WATER ENTOMOSTRACA.

Entomostraca, the significance of these facts cannot fail to appear. A similar parasite of Cyclops is *Filaria medinensis*.[1]

The Cladocera are generally quite free from parasites, but I have found in several instances young nematoids in the blood sinus in front of the heart in *Daphnia magna*. These are mouthless but very active round worms, subsisting upon the nutriment in the blood which constantly bathes the animal. True cysts could not be formed in the cobweb-like tissues of the hosts.

This is, so far as I can learn, the first publication of Entozoa from Cladocera. The animals were from "Schimels Teich," Leipzig. While collecting Copepods near Tuscaloosa, Ala., I gathered a number of specimens of *Cyclops tenuicornis* and nearly all were unusally pale and feeble. On examination they proved to be infested with a worm of the sub-order Distomeæ. This sub-order includes many distressing parasites and forms which are adapted to be widely distributed by a long period of adolescence and the number of stages passed through before maturity is attained.

The larvæ live frequently in Mollusca, and in maturity the animal inhabits the intestine of vertebrates.

Upon examination the Cyclops individuals collected were nearly all found affected, some having as many as five parasites of various sizes about the alimentary canal, in the common vascular cavity which corresponds to the entire arterial and venus system of the more highly organized Calanidæ. The Cercarian or tailed stage was not found. Were the life-history known it would probably appear that the larval stage is passed within some young mollusks, and that the adult infests some vertebrate, probably fish, and would thus be perhaps transferred either in food or drink to human system.

It is worthy of notice that the host was soon destroyed by the parasite, the post-imago or Coronatus form being absent; most of the individuals thus infested possessed abnormally persistent larval characters in antennæ, etc.

EXPLANATION OF PLATE V.

FIG. 1. *Diaptomus castor* (?), fifth pair of legs of adult male.
" 1*a*. " same (older specimen) showing a greater retrograde metamorphosis of inner ramus.
" 2. " caudal stylets of adult.

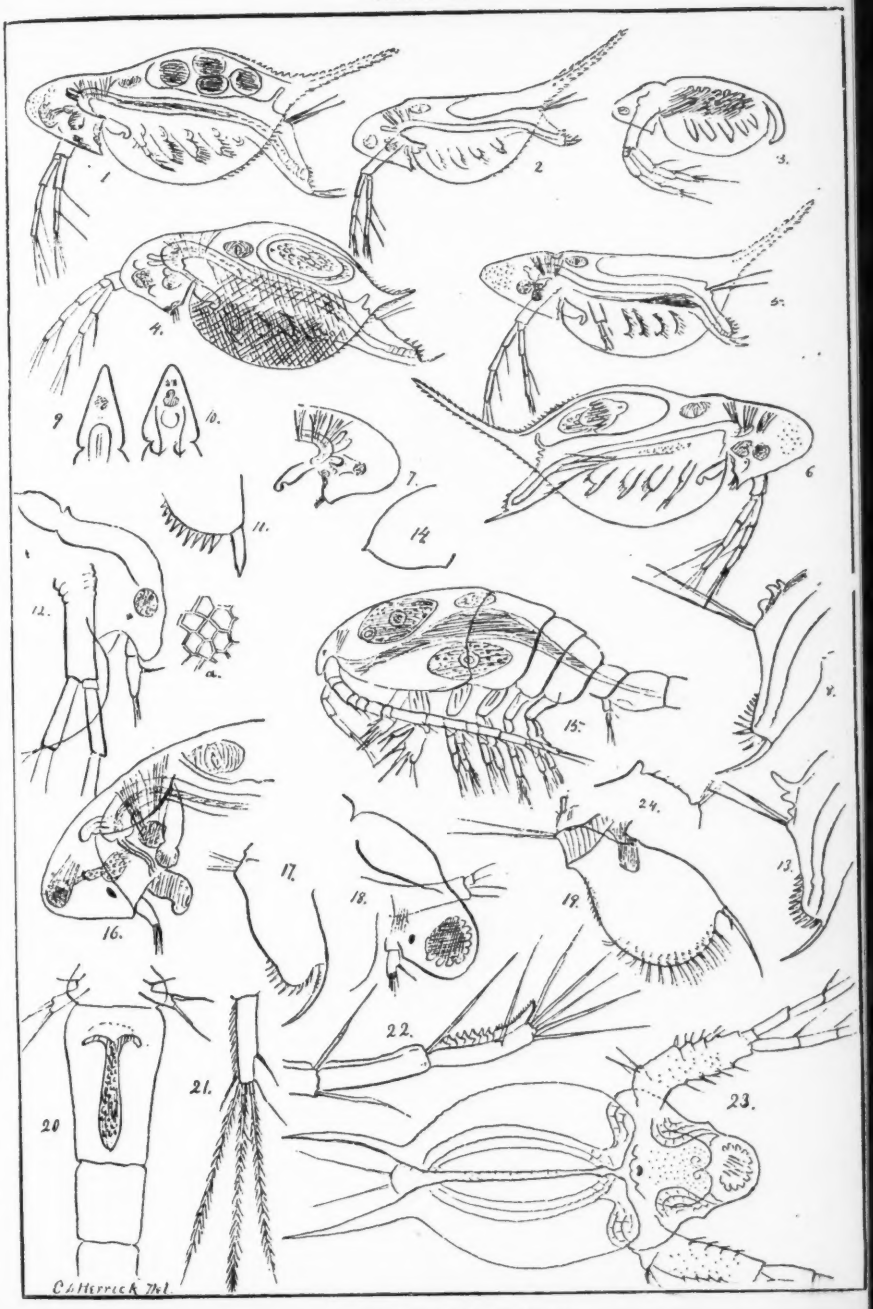
[1] Fedschenko. Ueber d. Bau. u. d. Entwicklung d. *Filaria medinensis*, Moscow.

FIG. 3. *Diaptomus castor* (?) fifth legs of adult female.
" 4. " fifth legs of male of exaggerated or *giganteus* form (immature).
" 5. " fifth legs of female.
" 6. " caudal stylets of same.
" 7. " margin of last thoracic segment of same.
" 8. " leg of immature specimen of ordinary form just prior to molt.
" 9. " antenna of male, *giganteus* form (immature).
" 9*a*. " antennæ of male, *castor* adult.
" 9*b*. " antenna of male, *castor*, older form.
" 10. *Epischura fluviatilis*, sp. nov., abdomen and fifth feet of male.
" 11. " right foot of male.
" 12. " right foot of female.
" 13. " right foot of female (young).
" 14. " mandible.
" 15. " labrum, mandibles and palpi.
" 16. " end of maxilliped.
" 17. " globular upper part of testis.
" 18. " end of antennules.
" 19. " antenna of male.
" 20. " swimming foot.
" 21. *Cyclops modestus*, sp. nov., fifth foot.
" 22. " stylets.
" 23. " end of antenna.
" 24. *Cyclops tenuissimus*, sp. nov., fifth foot.
" 25. " terminal joint of antenna.
" 26. *Schapholeberis angulata*, sp. nov. (*a*), antenna.
" 27. " first foot.
" 28. " lower angle of shell.
" 29. *Simocephalus vetulus*, outline of posterior portion of shell in old females (*a*) spines.
" 30. *Simocephalus daphnoides*.
" 31. " lower angle of shell.

EXPLANATION OF PLATE VI.

FIG. 1. *Daphnia longispina*,
" 2. "
" 3. "
" 4. "
" 5. *Daphnia dubia*.
" 6. "
" 7. "
" 8. "
" 9. "
" 10. *Daphnia longispina*.
" 11. *Ceriodaphnia alabamensis*, sp. nov., end of postabdomen.
" 12. " head.
" 12*a*. " reticulations of shell.
" 13. *Daphnia dubia*.
" 14. "

PLATE VI.



FRESH WATER ENTOMOSTRACA.

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FIG. 15. *Cyclops tenuicornis* infested with *Distoma* sp.?
" 16. *Simocephalus daphnoides*, sp. nov., head.
" 17. *Ceriodaphnia reticulata*, abdomen.
" 18. " head.
" 19. *Illiocryptus* sp., abdomen.
" 20. *Cyclops tenuissimus*, sp. nov., abdomen.
" 21. " caudal stylet.
" 22. *Cyclops tenuicornis* ("coronatus"), end of antenna.
" 23. *Scapholeberis armata* Herrick, front view.
" 24. " upper angle of abdomen.

(To be continued.)

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A STUDY OF THE IMMATURE PLUMAGE OF THE NORTH AMERICAN SHRIKES, TO SHOW THEIR DESCENT FROM A COMMON PROGENITOR.

BY THOMAS H. STREETS, M.D.

IT is seldom that we find a group where the variations can be traced from the progenitors in an unbroken line through the whole series. Such a group we have in the shrikes of North America.

Several years ago, before I had read the "Descent of Man," while studying the young of *Sula cyanops*, I was struck with its close resemblance to the adult plumage of *Sula leucogastra*. I brought this fact to the notice of Mr. Robert Ridgway, the ornithologist, and he showed me as a parallel case the young of the white-rumped and the adult of the great northern shrikes. I was strongly impressed by these cases, with the importance of the study of the changes of the plumages of birds, as bearing the same relation to their descent as the embryological changes of structure which certain animals exhibit. Some years afterwards I found out that Mr. Darwin had fully investigated the subject. In the beginning of the chapter[1] where he discusses the immediate plumage of birds he makes the following statement:

"When the young differs in color from the adult, and the colors of the former are not, as far as we can see, of any special service, they may generally be attributed, like various embryological structures, to the retention by the young of the characters of an early progenitor." He states, in reference to the importance of

[1]Descent of Man. Chap. XXI., p. 175. Amer. ed.

the subject, that "a full essay by some competent ornithologist is much needed." Neither did the color variations of the shrikes escape the patient search of this rigid investigator, but I am not aware that our own group has ever been studied to show their descent from a common progenitor. In this imperfect attempt I will select the marks of coloration of but one portion of the body; namely, the transverse wavy lines or bars and other masses of color on the under surface of the body. It is well known that spots and stripes are more apt to fade away or change than larger masses of coloration in the sexual variations of animals. All the facts here presented are taken from that excellent work, "A History of North American Birds, by Baird, Brewer and Ridgway."

Collurio borealis.—"Breast and belly always with distinct transverse waved lines of dusky." "In an immature bird, in winter, the dull white beneath is everywhere—sometimes even on the lower tail-coverts—covered with numerous bars of dusky, more sharply-defined, and darker than in the adult." Here we have, as far as this one character is concerned, the male, female and young resembling each other—"beneath with wavy bars of dusky in all stages."

C. ludovicianus.—This species carries us a step in advance. "Under parts often with very obscure faint waved lines (in the female?). Beneath, very strongly tinged with plumbaceous, laterally and across breast." The variation here has been transmitted through the female to the male, and in a modified degree to the female offspring. Our authors still further tell us that "the young bird is quite different from the adult, differing as does that of *excubitoroides*, but the colors are all darker than in the corresponding age of that species." Referring to *C. ludovicianus* var. *excubitoroides*, we are told that the young bird is marked on the "breast and sides with obsolete bars of dusky." In the case of *ludovicianus*, therefore, we have the young and female resembling each other, but differing from the adult male, and resembling, in a modified manner, both sexes and young of *borealis*.

C. ludovicianus var. *excubitoroides.*—"Beneath entirely white, without ashy tinge laterally or across breast." "No waved lines beneath." We have already seen that the young of this bird has obsolete bars of dusky on the breast and sides. It differs from both the male and female, and resembles the adult female of *ludo-*

vicianus. Here the male and female resemble each other, the sexual character being transmitted in an equal degree to both sexes. The only trace of the bars beneath is noticed in the winter dress of the male. According to Darwin, when the variation is sexual, and the adult male molts twice in a season, the winter dress resembles the primitive or immature plumage.

C. ludovicianus var. *robustus.*—The account of the plumage of this bird in its different stages is too meagre to serve our purpose. It is said to be without wavy bars beneath, and is "tinged with ashy laterally and across breast," in the adult stage. It is probably intermediate between *ludovicianus* and var. *excubitoroides.*

It is interesting to note in this connection the range of this genus spreading over half a continent.

The progenitor, *borealis*, inhabits "Arctic America; in winter south into the United States, especially into the northern portions." *Ludovicianus*, "South Atlantic and Gulf States." *Robustus*, "California and fur countries." *Excubitoroides*, "Western North America from Pacific coast east a little beyond the Mississippi, and to Texas. Nearly all of Mexico."

I am aware that this genus has also been modified in other ways by natural selection, but only those parts have been chosen which serve the purpose of showing their descent through sexual selection.

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EDITORS' TABLE.

EDITORS: A. S. PACKARD, JR., AND E. D. COPE.

—— There is still a disposition in certain quarters to disparage and even to ridicule attempts at the construction of genealogical trees. One criticism made is that they are nothing less than systems of classification. To this we would reply that of course they are. Our systems of classifications are efforts to display in a graphic way our conceptions of the affinities of natural groups. The more generalized forms are placed lowest and the more specialized higher, and the aberrant forms are placed at a distance from the more typical. Some naturalists arrange natural groups in the form of constellations; but the greater number, irrespective of any theory, copy, simply for convenience, the form of a tree with branches of unequal size and length. Unconsciously every systematic biologist thus constructs a genealogical tree. If now, he be an evolu-

tionist, believing that there is a blood relationship between the branches, twigs, and trunk and roots of his tree-like system, he acknowledges the fact that his graphic presentation of his systematic views really approximately represents what has actually taken place in nature. The branches of his genealogical tree are approximative to what practically are lines of descent or ascent. Certain twigs may be bent backward or downward, and they represent degradational paths, along which retrograde forms have traveled.

The historian of families or of nations constructs genealogical trees, and is it illogical that the naturalist should? Errors creep into historical genealogical trees. No two naturalists may construct the same form of genealogical tree for the same order or class; so no two observers agree as regards the classification of any group. Because our attempts at expressing our conceptions as to the origin and descent of certain groups are imperfect and provisional, it does not follow that the attempt should be ridiculed by those naturalists who are excellent as systematists and anatomists, but who do not work with their thinking caps on.

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RECENT LITERATURE.

SEELEY'S HISTORY OF THE SKULL.[1]—This pamphlet is a review of the various relations between the skull and the other structures of a vertebrate, with a view "to stimulate some other fellow-worker to seek for the meaning" of the unknown points in the problem. Professor Seeley shows: (1) That comparative anatomy proves an increasing simplification and approximation to the vertebral plan as we ascend the scale from fishes to mammals; yet that embryology shows that the skull originates in structures that have little in common with the vertebræ. (2) That a skull is difficult to define, for the branchial arches appear to be survivals of the somatic clefts of Amphioxus, and the visceral clefts of an embryo mammal are homologous with the branchial arches of a fish. (3) That a skull, as usually understood, consists of, first, a brain-case; second, of jaws, and third, of structures connected with respiration, which parts may, as in the sharks, have been originally separate. (4) That the bones surrounding the nasal, optic and auditory capsules are remarkably constant, especially the latter, so that it would appear that a brain-case "is a union of ossifications about sense-capsules that have come to surround the brain," yet this will not explain either the number or arrangement of the bones. (5) That the cartilaginous cranium originates from the parachordals and trabeculæ, which primitive elements do not suggest that tri-partite segmentation of the skull which is finally devel-

[1] *The History of the Skull*, by Professor H. G. Seeley, F.R.S., F.L.S. Read before the Science Society, of King's College, London.

oped. (6) That although the cartilaginous cranium (as that of the shark) becomes segmented in higher animals, that segmentation follows some law, which law may probably be found in a repetition in the skull of the manner in which, when the vertebral column becomes segmented, the lines of division pass through the middle of each protovertebra—thus their parachordals and trabeculæ would, by median division after the union, form three portions. (7) That of the median bones of the base of the skull, the presphenoid, which is a *median* vertebral element formed by the *paired* trabecular cartilages, that theoretically ought not to form such an ossification, can only be explained by the law that "the longer a type endures in time the more perfectly is the vertebral plan of that type superimposed upon the skull." (8) That the distinction of "membrane bones" and cartilage bones is not one of great importance, the former arising simply from the fact that the nervous substance of the brain "grows up so rapidly that the cartilage elements are unable to cover it." (9) That the face originates in the jaws, which in elasmobranchs are separate from the skull. The jaws are developments of the mandibulary cartilages, so that embryologically the lower jaw is the most important. The facial bones seem, as suggested by Balfour, to form two series, the inner consisting of vomer, palatine and pterygoid, the outer of maxillary, inter-maxillary and jugal. "It is quite possible that the six bones of the lower jaw, which in the lower vertebrates may be ranged into an outer and inner series of three each, correspond to the inner and outer bars of the palato-maxillary region? If the segmentation is not carried downwards from the brain-case, it is difficult to account for it." Yet whatever explains the segmentation of the hyoid and branchial arches will also account for that of the face. Professor Seeley thinks it possible that the nasals, the labial cartilages of the elasmobranchs, are the basis of the nasals and premaxillaries.

Why any of these cartilages, including the branchial cartilages, should first come into existence as they do, without any obvious relation to skull structure, and yet finally become the framework of the skull is beyond the limits of knowledge, and the only key (here Professor Seeley exhibits Lamarckianism equal to that of some of our American naturalists) "is found in the law that function modifies, molds and originates structures, on the basis of antecedent organization." Professor Seeley also lets fall the pregnant remark that many of the difficulties of comparative anatomy may possibly vanish when "embryology becomes the servant instead of the law-giver of morphology."

GRAFF'S MONOGRAPH OF THE TURBELLARIANS.[1]—The two volumes folio of text and plates (all from the author's own drawings) are devoted to the Rhabdocœlida, of which Professor Graff has

[1] *Monographie der Turbellarien.* I. Rhabdocœlida. Dr. LUDWIG VON GRAFF. Leipzig, W. Englemann, 1882.

examined seventy species out of a hundred and sixty-eight that are certainly known. The author considers *Rhodope varanii* to be a nudibranch, and excepts the Microstomida and the Nemertines from the Turbellaria. The former differ from other Turbellaria in having a complete peri-œsophageal nerve-ring, as well as in being diœcious, and in their power of multiplying by budding. Thus the Turbellaria consist only of the Rhabdocœlida and Dendrocœlida, the former of which Professor Graff divides into (1) Accela, forms without nervous system, or excretory organs; as well as without a digestive tract and parenchym tissue, but with an otolith; (2) Rhabdocœla, with all the foregoing except (usually) the otolith, and (3) Alloiocœla.

The Zoological Record for 1881.[1]—This Record is about as bulky as its predecessors, in fact numbering thirty-six pages more than that for 1880, showing that the literature for 1881 was not less in extent than in previous years. The volume appears promptly, within a year from the close of the year recorded. The staff of recorders is eleven, not including the editor, Mr. Rye. It appears that the year 1881 was, as far as work on mammals is concerned, rather a dull one, no fresh, separate works of importance appearing, though there was no diminution in the number of papers. Ornithology made a better exhibit, as some important general works appeared. More room seems to be given in this volume than in some of its predecessors to abstracts of anatomical and embryological papers, and we hope that this method will be more extensively purused hereafter, so that the Record will be useful not only to the systematist but to the general student of zoölogy. As it is, however, a work of this kind in the English language is simply invaluable. The student in any department, next to the scientific journals bearing on his specialty, needs a copy of this Record. It is almost a zoölogical library in itself, for it tells the student where to look for the papers in his specialty, thus saving him much valuable time, and preventing his doing over work which may already have been done by some one else.

The number of new genera and subgenera is 1438, as against 1008 of the Record for 1880.

The German Zoological Yearly Record.[2]—This Record, with the exception of the part on Vertebrates, promptly made its appearance the first of January. It is nearly twice as bulky as the English Record, and fuller abstracts are given of morphological and embryological papers and works, as well as the character of new genera. The list of recorders amounts to thirty-four. The general editor is Professor J. Victor Carus, assisted by Dr. P. Mayer.

[1] *The Zoölogical Record for 1881;* being volume eighteenth of the Record of Zoölogical Literature. Edited by E. C. Rye. London, John van Voorst, 1882. 8vo.

[2] *Zoölogischer Jahresberichi für 1881.* Herausgegeben von der Zoölogischen Station zu Neapel. Abtheilung i–iii. 1882. Leipzig, W. Englemann. 8vo.

The arrangement is comprehensive and convenient. It gives the titles and brief abstracts of articles and works under the following heads: 1. History of zoölogy and comparative anatomy, biographies, necrology for 1881; 2. Literature of zoölogy and comparative anatomy; 3. General principles—nomenclature; 4. Handbooks, atlases and other literary aids; 5. Means of research and observation, including microscopy and miscroscopic apparatus, section-cutting, staining, etc., and histological work; zoölogical gardens, aquaria, zoölogical stations, dredging, etc.; 6. Zoögeography, faunæ; 7. Theories of descent and phylogenies; 8. Biology in general; 9. General ontogeny, egg-fertilization, sexes; 10. Special groups of animals, beginning with protozoa and ending with vertebrates.

Comparing the British Zoölogical Record with the present one, we find, under Spongiæ, that the former gives the titles of eighteen works and papers, while the German Record has forty-two. The British Record does not mention the writings of M. Braun, R. O. Cunningham, J. W. Dawson, W. Dybowski, A. Giard, C. W. Gümpel, T. Mayer, C. Mereschkowsky, P. Pavesi, W. J. Sollas, Wallich, E. P. Wright, as well as some by Sollas, Carter and Walcott. Hence, as regards the literature of Sponges the student would find the English Record imperfect. The English Record, in some departments, enumerates palæontological papers, in others not; thus, under Brachiopoda only two papers, one by Dall and the other by Oehlert are enumerated, while the German list of titles numbers twenty-three. Under Echinodermata the German Record gives eighty-two titles; the English Record has twenty-nine, palæontological papers not being mentioned; but papers on living Echinoderms are mentioned in one which are not referred to in the other Record; so with the Vermes, Crustacea, Myriopoda, Arachnida and Insecta. Thus, there are important omissions in each Record. The moral of this is that every zoölogist should send copies of his papers and works to the respective editors of each Record, so as to render them more perfect; meanwhile the student needs both works.

Revised Edition of Leconte's Geology.[1]—The valuable features of this work, and which have given it wide usefulness and popularity, is the simple, compact and agreeable style in which the subject is presented. For the general reader also the book is well proportioned, as the general bearings of the subject upon biological problems, the antiquity of man, the evolution of our continent and of the assemblages of life which have successively peopled its surface are clearly indicated. It is designed and adapted rather for the beginner or general reader than for the field geologist or advanced student.

[1] *Elements of Geology:* A Text-book for Colleges and for the General Reader. By Joseph Le Conte. Revised and enlarged edition. New York, D. Appleton & Co. 1882. 8vo, pp. 633.

The revisions and additions bring the work down to the present date. In dynamical geology, Croll's and Thompson's theories of glacier motion have been added. In the part on structural geology the chapter on igneous rocks has been entirely rewritten and greatly enlarged. Under vertebrate palæontology the author has failed to notice the greater number of modern additions to the science, and has apparently confined himself to but one source of information, and that not the best. He says "I have added the most important results of the investigations of King in regard to the tertiary and quaternary lakes of the Rocky Mountain region; and of Chamberlain, Upham and others, in regard to the ice-sheet moraine. I have also given somewhat fully Croll's theory of the climate of the glacial epoch, and Wallace's modification of the same. These changes have involved the addition of many new figures." Among them is a wood-cut of the Berlin Archæopteryx.

We meet with the following statement on p. 324, which needs revision at the present date. "According to Agassiz, we know more of the development of trilobites than of any living Crustacean." On p. 399, in enumerating the Crustacean fauna of the Carboniferous, the discovery, a few years ago in Belgium, of a genuine crab (*Brachypyge carbonis*, Woodward) is overlooked. The discovery by Mr. Whitfield of a genuine Devonian shrimp (*Palæopalæmon newberryi* Whitf.) was also worthy of mention. Under the head of theories of coral reefs reference might have been made to Semper's and also to Mosely's theories.

ZITTEL'S HAND-BOOK OF PALÆONTOLOGY.[1]—As we have stated in noticing the earlier parts of this work, it is the most comprehensive, compact and valuable manual of the subject to be had, and has sufficiently frequent references to and figures of American fossils. This part embraces the univalves or Cephalophora, for which the author prefers the name Glossophora. Whatever we call them, this will prove one of the most useful parts of this important work, which we are purchasing for our own use, and find so thoroughly well prepared and illustrated that we earnestly recommend it to our readers as an indispensible book of reference. The wood-cuts are excellent.

DAVIS' GLACIAL EROSION.[2]—This is a very readable and convenient summary of the opinions of geologists as to the actual effects of glaciers in remolding the earth's surface. It would appear that this department of geology is peculiarly inexact as a

[1] *Handbuch der Palæontologie.* Herausgegeben von KARL A. ZITTEL. 1 Band. 2 Abtheilung, 11 Lieferung mit 265 original-holzschnitten. Preis marks 7. München u. Leipzig, 1882. 8vo. R. OLDENBOURG.

[2] *Glacial Erosion.* By W. M. DAVIS. Read before the Boston Society of Natural History, etc. Boston, 1882. 8vo., pp. 37.

science. Summarizing geological opinions, Mr. Davis thus concludes, in a way which seems to us to be reasonable and sound: "The amount of glacial erosion in the central districts has been very considerable, but not greatly in excess of preglacial soils and old talus and alluvial deposits. Most of the solid rock that was carried away came from ledges rather than from valleys; and glaciers had in general a smoothing rather than roughening effect. In the outer areas on which the ice advanced it only rubbed down the projecting points; here it acted more frequently as a depositing than as an eroding agent.

"No large lakes have been produced by glacial erosion; the number of true rock-basins of erosion has been greatly exaggerated. The most considerable topographic effect produced by glaciers is the heaping of various morainal deposits on an area smaller than their source, and in this way very often forming hills of considerable size. A similar indirect result of glacial erosion is seen in the very numerous lakes made by drift obstructions in preglacial valleys."

LYMAN'S OPHIUROIDEA OF THE CHALLENGER EXPEDITION.[1]—This sumptuous quarto is in fact a monograph of the sand-stars of the world. In reporting on the twenty new genera and one hundred and sixty-seven new species collected by the *Challenger*, with many forms previously known, but which formed a part of the collection, Mr. Lyman, who for about twenty years has devoted his attention to this group, wisely adds the names of all other Ophiuroidæ and Astrophytidæ previously described, and thus the work becomes a hand-book of the two families mentioned. The accomplished author indulges in three or four pages humorous, satirical and critical, regarding genealogical trees, which he humorously styles "a sort of zoölogical herald's college." He then pays his respects to the "jargon in which zoölogy is now smothering," and goes on to say that "in addition to a gigantic classification, to form which the dead languages have been torn up and recomposed, there is an ever-growing crop of anatomical and embryological terms." It is time, we think, that criticism should be directed against the tendency to increase an already superfluous nomenclature, however useful or judicious a limited one may be.

MILLER'S AMERICAN PALÆOZOIC FOSSILS.[2]—Every American

[1] *Report on the Scientific Results of the Voyage of H. M. S. "Challenger," etc. Zoölogy*—Vol. v, part XIV. Published by order of her Majesty's Government. London, 1882. 4to, pp. 386. 48 plates. 38s.

[2] *The American Palæozoic Fossils.* A catalogue of the genera and species, with names of authors, dates, places of publication, groups of rocks in which found, and the etymology and signification of the words. By S. A. MILLER. pp. 334. Cincinnati, Ohio. Published by the author.

geologist, and, in a scarcely less degree, every European one whose geology is sufficiently comprehensive, must welcome such a work as the present, and thank Mr. Miller for the patient care with which he has arranged nine thousand valid generic and specific names, besides more than two thousand italicized synonyms. The author does not claim perfection, but has taken care to come as near to it as can reasonably be expected. With the exception of three names in the Echinodermata, no families have been admitted except such as have been already defined. The etymology has received, in great part, the revision of Professor E. W. Claypole, who contributes a preface upon the construction of systematic names in palæontology. This is followed by an introduction to stratigraphical geology; in which Mr. Miller clearly states his belief in the fossiliferous nature of Eozoon; gives the approximate thicknesses of the groups of strata and states at what horizon the various animal groups first made their appearance. The total thickness of the palæozoic beds is given at about twenty-eight miles. The classification is not up to the present standard. All the plants enumerated are given under the caption "Plantæ;" Haeckel's name, "Protista," is used to include the Rhizopoda and Porifera, among which Nullipora has in some way become intercalated; the sub-kingdom, Radiata, is retained, and its species are alphabetically arranged under the heads "Polypi" and "Echinodermata;" and the Bryozoa and Brachiopoda are classed as Mollusca, but are separately catalogued. No attempt is made to define the characters of any family or larger group, excepting in the case of some new groups of *Echinodermata*, which we will refer to again. There are, as might be expected in so exhaustive a work, some etymological errors, especially among the names of the Vertebrata. The work is a valuable one, and will lose none of its value by the demonstration of a few shortcomings which a third edition may easily correct.

Remarks on the Systematic Arrangement of the American Turdidæ.[1]—Dr. Stejneger gives, in the last sheets of the Proceedings of the U. S. National Museum, a systematic analysis of the family of the Turdidæ or thrushes. We find this paper to be more intelligible than the systematic writings of ornithologists usually are, and commend it as a valuable monograph. The nominal family of the Saxicolidæ is abolished; the Myiadestinæ are included, while the Miminæ are dismissed to the wrens. All this and much more comes from relying on structure instead of physiognomy, and abandoning "instinct" in favor of analysis. Under criticism like that of Mr. Ridgway and Dr. Stejneger, ornithology will soon rank among the exact sciences.

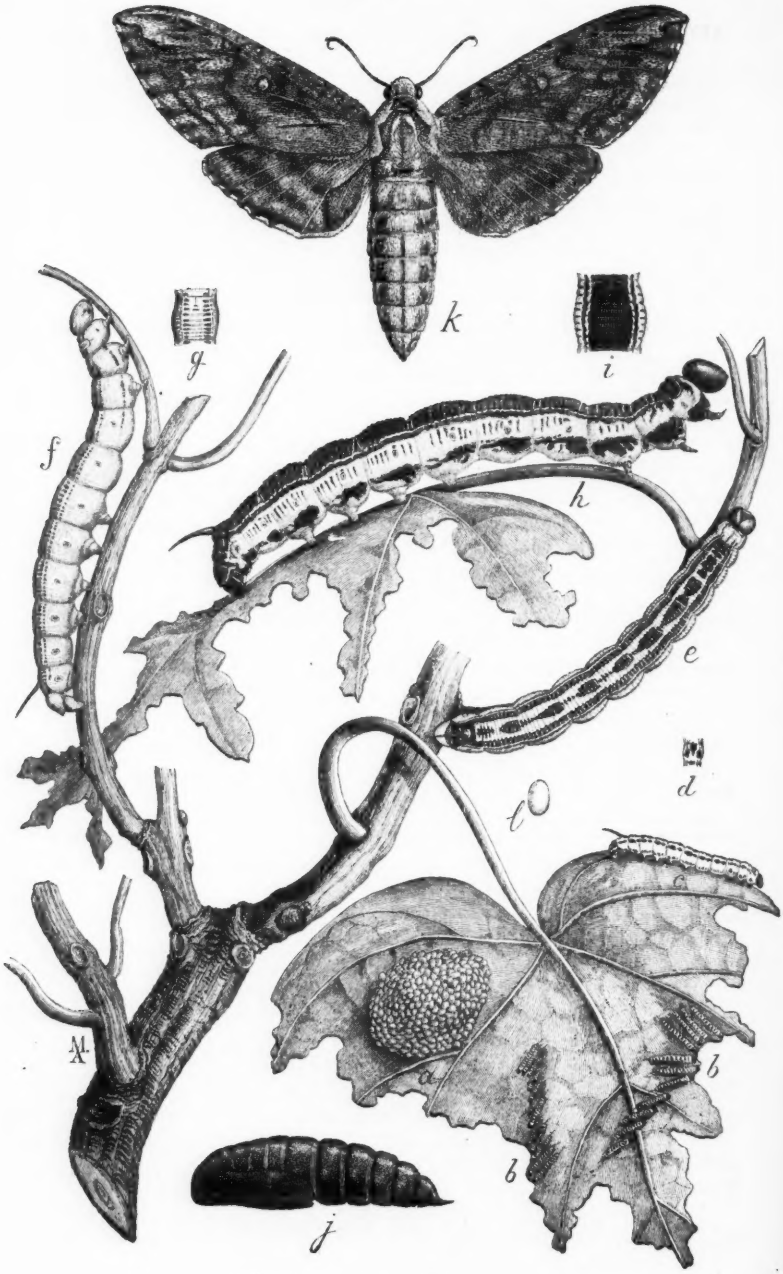
[1] Proceedings of the U. S. National Museum, 1883, p. 449.

THE UNITED STATES AGRICULTURAL REPORT FOR 1881 AND 1882.—In former years the agricultural reports were scarcely worth the paper on which they were printed. Compiled statements and unsafe statistics, with hundreds of pages of "padding" filled out the pages. In the bulky report before us we see the evidence of a new state of things. A large proportion of the volume gives to the people the results of field and laboratory work by scientific experts who are thoroughly competent and have the confidence of scientists as well as of the public. The report of the entomologist, Professor Riley, follows that of the commissioner, Hon. George B. Loring, and occupies upwards of 150 pages, considerable original matter having been excluded for want of space. Professor Riley was assisted during the year 1881, in the office work and in the preparation of reports, by Professor W. S. Barnard, Messrs. L. O. Howard, E. A. Schwarz, T. Pergande, B. Pickman Mann, with a number of other agents and observers in different parts of the country, while Mr. Riley's predecessor, Professor J. H. Comstock, was engaged at Ithaca, N. Y., on a special report upon fruit and other insects which appears in the present report. From the many life-histories of insects published in the present report, and the unpublished notes which have accumulated, as well as the character of the entomologists engaged in the work, both in Washington and in different parts of the Union, North and South, East and West, it will be seen that from a purely scientific point of view, we have here an amount of biological work accomplished which is most gratifying; and while science is advanced, the most practical results are given to the people. We have not space to enumerate the insects treated of, but they are those most injurious to crops, with many whose habits have been worked out for the first time. As a sample of the excellent illustrations, of which there are twenty plates, some of which are colored, we are allowed to reproduce Pl. XII, which illustrates the life-history of *Sphinx catalpa*, which feeds on the catalpa and is of exceptionable interest because it lays its eggs in a mass (*a*) instead of singly, and for the reason that the caterpillars are at first gregarious (*b*). It also gives an idea of the skill of the artist, Mr. Marx. The chromo plates illustrating the entire life-history of the boll worm and the army worm are excellent.

A prominent feature of the report is the space given to insecticides, and the means of applying them. Here American inventiveness and ingenuity, based on sound field work and observation, are conspicuous. Perhaps the spraying machine devised for the protection of cotton, represented on Pl. IX, is the best example of such a wholesale way of destroying insects which has been devised.

The report of the botanist, Professor G. Vasey, is on the wild and cultivated grasses of the United States. It is succeeded by

PLATE VII.



TRANSFORMATIONS OF SPHINX CATALPA.

lengthy and fully illustrated reports of the veterinary division, followed by that of the chemist, Professor P. Collier, on sorghum, a voluminous and able report.

The report certainly does credit to the management of the department, which has not spent its strength in visionary schemes, but is grappling with problems directly involving the public interests.

RECENT BOOKS AND PAMPHLETS.—Reports of Geological Explorations during 1881, with maps and sections, Wellington, New Zealand. J. Hector, M.D., etc., director. From the colonial museum and geological survey department.

Hand-book of vertebrate dissection. Part II. How to dissect a bird. By H. Newell Martin, M.D., and W. A Moale, M.D. New York, Macmillan & Co. From the publishers.

The Journal of the Postal Microscopical Society, a miscellany of natural and microscopic science. Edited by A. Allen. Vol. I. London, England. From the editor.

Report of an Exploration of parts of Wyoming, Idaho and Montana in August and September, 1881, made by Lieut.-Gen. P. H. Sheridan. With the itinerary of Col. J. F. Gregory and a Geological and Botanical Report by Major W. H. Fortwood, surgeon U. S. army. From Dr. Forwood.

Premiere note sur les Dinosauriens de Bernissart. Par M. L. Dollo. Ext. du Bulletin du Musée Royal d'Histoire Naturelle de Belgique. From the author. Also by and from the same—

Deuxieme note sur les Dinosauriens de Bernissart.

Dr. H. G. Bronn's Klassen und Ordnungen des Thier-Reichs. Sechster band. III Abtheilung. Reptilien.

Synopsis of the Mutillidæ of North America. By Chas. A. Blake. Phila. American Entomological Society. From the author.

Sitzungs-bericht der Gesellschaft naturforschender Freunde zu Berlin, 1881. Nr 1–10.

Amerikai Utamból (1882 Julius–Szeptember). Irta Dr. Szabó Jósef. Buda Pest, 1882. From Dr. J. Szabo.

Our Country; its present and future prosperity. With a supplement. By D. M. Richardson. Detroit. From the author.

Memorial to the late Professor Balfour. Forwarded with the compliments of the committee.

The Eozoic and Lower Palæozoic in South Wales, and their comparison with their Appalachian analogues. By Dr. Persifor Frazer. 1883. From the author.

A contribution to the geology of the Lower Amazons. By Orville A. Derby, M.S. Rep. from the Proc. Amer. Philosophical Society. From the author.

The Geology of the Diamantiferous region of the province of Parana, Brazil. By O. A. Derby. Read by permission of the director of the Brazilian Museum, before the Amer. Philosphical Soc. From the author.

Cold-blooded Vertebrates and Lepidoptera of Wisconsin. By Dr. P. R. Hoy. From the author.

Le Crociere dell' Yacht "Corsaro" del Capitano armatore Enrico d'Albertis. Note erpetologiche e descrizione di una nuova specie di Lacerta delle Isole Canarie. Per W. Peters e G. Doria. From the authors.

Sitzungsberichte der Königlich Preussischen Akademie der Wissenschaften zu Berlin. XXVI. Ueber eine neue Art und Gattung der Amphisbænoiden. XL. Ueber eine neue Gattung und Art der Vipernattern. XLV. Ueber Sphæronycteris loxophyllum, eine neue Gattung und Art de Frugivoren Flederthiere, LII. Ueber Opisthoplus degener, eine neue Gattung und Art der Schlangen. All by W. Peters. From the author.

Catalogues of the New Zealand Diptera, Orthoptera, Hymenoptera, with descriptions of the species. By Fredk. W. Hutton, F.G.S. From the author.

Les petits Mammifères de la France. Par Dr. E. L. Trouessart. From the author.

Sur les construction turriformes des Vers de terre de France. Par M. E. L. Trouessart. From the author.

Memoires de la Société Géologique de France. Troisieme série, Tome second. IV. Recherches sur les Reptiles trouvés dans le Gault de l'est du bassin de Paris. Par M. H. E. Sauvage. From the author.

Nachträge zur Dyas II. Von Dr. H. Bruno Geinitz und Dr. J. Victor Deichmöller. Ext. from Mittheilungen aus dem Königlichen mineralogisch-geologischen und praehistorischen Museum in Dresden. From the authors.

Studien ueber die fossilen Reptilien Russlands. Von W. Kiprijanoff. II, Theil. Gattung Plesiosaurus. Ext. Mémoires de l'Academie Impériale de Sciences de St. Petersbourg. From the author.

On the results of recent explorations of erect Trees containing animal remains in the Coal formation of Nova Scotia. By J. W. Dawson. Ext. Philosophical Trans. Royal Society. From the author.

Allen's Human Anatomy. Section III, Muscles and Fasciæ. By Dr. Harrison Allen. From the author.

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GENERAL NOTES.

GEOGRAPHY AND TRAVELS.[1]

AFRICA.—Commander Gallini, gives, in the last *Bulletin* of the Paris Geographical Society, a map and illustrations of the scenery of the Upper Niger and Segou, showing formations that somewhat resemble the buttes of North America.

Mr. J. Thomson has left for Zanzibar, and trusts, about the middle of March to start upon a journey of exploration along the east coast of the Victoria Nyanza. He will also penetrate into the Masai country. The expedition is at the expense of the Royal Geographical Society, and will probably be absent about two years.

F. Lupton Bey's last letter, dated May 10th, 1882, gives some latitudes that affect materially the maps of the countries to the west of the Upper Nile. He refers to a lake called Key-el-Aby, which is evidently the Kœydabo of Count Escayrac de Lauture, and the "vast lake" heard of by Heuglin and Miani. Its position appears to be in about lat. 2° N., long. 25° E., or within a hundred miles of the Congo.

The January issue of the proceedings of the Royal Geographical Society contains an account of Dr. Junker's explorations in the region of the Welle, near the Monbutta country. Dr. Junker accompanied the Egyptian detachment sent in pursuit of Manbangà. The real name of the Welle is Mákua, since Welle is but the native name for river. In about lat. 4°N., long. 26 E., the Mákua receives a considerable tributary from the south, named the Bomokándi, but on Dr. Schweinfurth's map figured as the Nemayo, another name signifying river. The country between the Mákua and Bomokándi is inhabited by a negro tribe,

[1] This department is edited by ELLIS H. YARNALL, Philadelphia.

governed by Zanileh chiefs. Beyond the Bomokándi live the A-Babúa, who speak a tongue akin to the Monbutta. From the A-Mezimá country, Dr. Junker went south, to visit the chief Bakangar; thence ten days east to Kanna's, and thence northward to Tangasi, near Munza's old residence.

From thence he went three days east to the Zeriba Kabba, and thence to Gango and the head of the Gádda river in the Momvú country. On March 26th, last, he left Kabbi to visit Munza's two brothers, who live beyond the upper Bomokandi. "If native information can be trusted," says Dr. Junker, "the Mákua is the head stream of the Shari, whilst the Nepoko, a river rising far to the east and flowing south, is Stanley's Aruwimi," and thus a a tributary of the Congo.

The French are rapidly advancing their hold upon the Niger. Ahmada, King of Sego, signed in March, 1881, a treaty by which he placed his kingdom under French protection. A force of about 1000 men is now organized upon the Upper Senegal, destined for Bamaku, on the Niger, and a railway which was commenced last year, is to connect Kai, at the head of navigation on the Senegal, with the Kila and the Niger.

The Ancobra River and Axim Gold District, upon the Gold Coast, have been roughly surveyed, with a view to the construction of a road to Targuah, the center of the mining district. Western Akim and Aguna are rich in gold.

THE OASIS OF OUARGLA.—One of the most important oases of the Sahara, and one which will be of great importance to the French in the event of the construction of a trans-Saharian railway, is that of Ouargla. This oasis is situated in a large valley which, according to tradition, was formerly one vast garden, containing 125 villages and 1055 artesian wells. Even now the oasis of Ouargla, with the adjoining smaller ones, contains more than 450,000 palm trees. Artesian water is found at thirty-five meters (about 115 ft.), and the soil, like that of the schotts and "sebkhas" around is quartz sand, more or less charged with gypsum and sea-salt. These salts are more abundant in the uncultivated region, yet a certain quantity is needed for the prosperous growth of the palm.

The strata around the depression are Quaternary, while those of the water-bearing area itself are modern or recent alluvium. The lower and wetter portions of this and similar areas are called "sebkhas," while the shallow pools are "schotts." The shells found, fossil or sub-fossil, in this region are principally those which live in fresh or brackish water, the sole exception being the common cockle of the old world (*Cardium edule*), which is, however, abundant near the mouths of rivers and in lagoons. M. Rolland's conclusion is, that the Quaternary deposits of the Sahara are those of a vast closed sea or lake.—*Revue Scientifique.*

GEOGRAPHICAL NOTES.—M. Desiré Charnay has returned to France from his travels in Yucatan, where he has studied the ruins of Aké, Chichenitza and other cities. Aké is one of the oldest centers of the peninsula, and contains from eighteen to twenty pyramids, which, with what remains of their superstructure, belong to the early "cement" epoch of Toltec architecture. M. Charnay does not credit the great age some attribute to Toltec remains, but believes those of Yucatan not to antedate the commencement of the fifteenth century. Chichenitza is of hewn stone, and is more modern than Aké. Near the junction of the Mexican provinces Chiapas and Tabasco with Guatemala, M. Charnay found the remains of a center not before known except to the mahogany-cutters, and named it "Lorillard City," after the well-known P. Lorillard, who partially defrayed the expenses of the expedition. The ruins greatly resemble those of Palenque.—— Colonel Prejevalsky is superintending the printing of the account of his third journey, which is promised to appear before he sets out upon his fourth expedition, which will be in March of this year.——The Swedish expedition to Spitzbergen, under the leadership of Baron G. de Geer and Herr Nathorst, has furnished maps which give the outlines of the fjords and valleys of the southern part of that island, and the relative depths of the sea around it and Scandinavia. A comparatively level plateau extends between these two lands, which may be considered as ridges rising from it. West of Spitzbergen this plateau sinks abruptly into the ocean. The mountain sculpturing of Spitzbergen is due to the action of glaciers during the glacial epoch, after which a subsidence occurred, followed by a considerable elevation, proved by the existence of gravel beaches and marine beds far inland. The plants and animals of the island are Scandinavian, and this fact, as well as the fossils present, point to a probable former land connection along the line of the plateau, causing the Gulf Stream to bathe the western coasts of Spitzbergen and give it a milder climate than at present.

GEOLOGY AND PALÆONTOLOGY.

INTERMITTENT WELLS IN NEBRASKA.—In the neighborhood of Shelby, Polk county, Nebraska, are many wells which exhibit peculiar phenomena of intermittence. The wells of the district vary from 100 to 140 feet in depth, and ebb and flow irregularly. The flow is accompanied by a roaring sound like that of the sea, as though a distant wave were coming in, and at the same time a current of air issues out of the mouth of the well. The ebb is accompanied by a draft of air downwards into the well.

The period of ebb and flow does not appear to depend upon heat or cold, upon the dampness or dryness of the atmosphere, upon the season of the year, or upon the time of day; but, on the other hand, seems to be in some way connected with the direction

of the winds. When the wind blows from the south, south-east or south-west, the phenomena of flow occur, while the ebb is synchronous with a north, north-east, or north-west wind. The roaring sound before mentioned, is observed to occur some time before the wind commences to blow. One of these intermittent wells, 113 feet in depth, is situated upon the farm of George Bull, at Shelby, seventy miles from Lincoln. Similar wells occur in the adjoining county of Butler.

We, the undersigned, certify that the above statements are correct:

James Mackie,	Levi Cunningham,
J. D. Coery,	Stephen Cunningham,
R. Sizer,	John H. Anderson,
T. Cowan,	J. P. Kinney,
Jacob Schmid,	Amos Bull.
George Bull,	

Address any of the above at Shelby, Polk county, Neb.

[It is further stated that the wells above mentioned only pass through "soil" (probably the loess) and reach water at its bottom, which rests on a bed of gravel. The farmers of the region in question think that this water-bearing level is identical with that of the water of the Platte river, which bounds those counties on the north.—*Eds.* Naturalist.]

Lydekker on Indian Mammalia.—Two new parts of the Palæontology of the Geological Survey of India have come to hand. These include synopses of the extinct Rhinoceroses and horses, and additions to the Proboscidia. The descriptions and figures are welcome, and indicate again the richness of the tertiary Indian fauna, and the large size of many of the species. We must take exception to Mr. Lydekker's systematic ideas. He discards most of the genera of the Rhinocerontidæ, adopting only two, Aceratherium and Rhinoceros. The only difference between these is the absence and presence of the nasal dermal horns, a character no better or more constant than various others, which he ignores. Aphelops is united with Aceratherium, although it has three digits in the manus while Aceratherium has four, because the "number of digits can rarely be ascertained!" He objects to Cope's dental formula for incisor teeth of the restricted genus Aceratherium as being inaccurate. Had Dr. Lydekker been acquainted with the American species referred to that genus at the time of writing, he would have discovered that the diagnosis is correct as applied to them. The American forms, *A. mite* and *A. nebrascense*, have since been separated under the generic head Cœnopus. Dr. Lydekker cannot discuss the American species of Aphelops, "because no figures of the crania have been given." Good figures of three of the species will be found in the Naturalist, 1879, p. 771c et seq.

In the horses, Hippotherium is placed in the Equidæ, Dr. Lydekker evidently attaching more importance to the presence of cementum on the molars, than to the number of toes. Protohippus is not referred to. Hippidium is united with Equus, a course which future discovery may sustain.—*E. D. Cope.*

THE ANCESTOR OF CORYPHODON.—In describing the genus *Pantolambda* I remarked that it was "founded on a mandibular ramus, which supports the first true molar, and the last two premolars. The characters of these teeth remarkably resemble those of Coryphodon. * * * It will be for additional material to demonstrate whether this genus belongs to the Amblypoda or Perissodactyla."

A considerable part of the skeleton of *Pantolambda bathmodon* having been recently sent me by Mr. D. Baldwin, I am able to throw much light on the affinities of this curious animal.

In the first place, the phalanges (with ungual), show that the genus is ungulate. Secondly, the astragalus has a large distal facet for the cuboid bone. This proves that the genus cannot be referred to the Taxeopod order. The question as to whether it belongs to the Amblypoda or the Diplarthra would be decided by the carpus, but that part is unfortunately not preserved, and I have to rely on empirical indications for a provisional determination. Apart from the astragalus, the characters are those of the Condylarthra rather than of the Perissodactyla, and it is therefore to be supposed that the carpus has also the characters of that order. This would place the genus in the Pantodonta, which has the carpus nearly that of the Taxeopoda, and the tarsus of Diplarthra. The points of resemblance to the Condylarthra are the following: The ilium is narrow. The humerus has an epitrochlear canal. The superior molar teeth have but one internal lobe. The resemblances to the Pantodonta are these: The cervical vertebræ are plane and short. The femur has a third trochanter. The premaxiliary bone is dentigerous. The astragalar trochlea is as in the Periptychidæ, and the Proboscidia; that is, without groove, and slightly convex anteroposteriorly, thus differing from that of the Pantodonta. The dentition is especially like that of the Amblypoda in general, and that of the superior series is unlike anything known in the Diplarthra.

I propose to place this genus in the Amblypoda for the present, next to the Pantodonta, but it cannot enter that sub-order on account of the form of its astragalus. The sub-orders of Amblypoda will be defined as follows:

Astragalus with a head distinct from trochlea, with distal articular facets..... *Taligrada.*
Astragalus without head; distal facets subinferior..... *Pantodonta.*

In the sub-order Taligrada, the single family *Pantolambdidæ* presents the following characters:

Superior and inferior molars with the cusps developed into Vs.

Postglenoid process present; posttympanic and paroccipital not distinct. All the vertebræ with plane articulations. Humeral condyles without intertrochlear ridge. Femur with third trochanter. Digits of posterior foot probably five. Metapodial keels small and posterior.

Of this family Pantolambda is as yet the only known genus. Its leading cranial characters are as follows:

Canine teeth large; dental series continuous. Superior molars all triangular, that is with a single internal cusp. External cusps of premolars unknown; of molars two. Internal cusp V-shaped, sending its horns externally as cingula to the anterior and posterior bases of the external side of the crown, without intermediate tubercles. Inferior true molars with a crown of two Vs, the anterior the more elevated. Premolars consisting of one open V, with a short crest on a short heel, as in Coryphodon. Dental formula $I\frac{3}{3}$; C. $\frac{1}{1}$; P-m. $\frac{4}{4}$; M. $\frac{3}{3}$; the last inferior with a heel. A strong sagittal crest. Auricular meatus widely open below. Large postparietal, postsquamosal and mastoid foramina.

The brain case indicates small and nearly smooth hemispheres, extending with little contraction into a rather large cerebellum. The olfactory lobes are produced anteriorly at the extremity of a rather long isthmus.

If we consider the dentition alone, Pantolambda is the ancestor of Coryphodon. The history of the feet requires further elucidation.

The *Pantolambda bathmodon* is about as large as a sheep, and comes from the upper beds of the Puerco.—*E. D. Cope.*

Note on the trituberculate type of Superior Molar and the origin of the quadritubercular.—It is now apparent that the type of superior molar tooth which predominated during the Puerco epoch was triangular or tritubercular; that is, with two external, and one internal tubercules. Thus of forty-one species of Mammalia of which the superior molars are known, all but four have three tubercles of the crown, and of the remaining thirty-eight all are triangular excepting those of three species of Periptychus, which have a small supplementary lobe on each side of the median principal inner tubercle.

This fact is important as indicating the mode of development of the various types of superior molar teeth, on which we have not heretofore had clear light. In the first place, this type of molar exists to-day only in the insectivorous and carnivorous Marsupialia; in the Insectivora, and the tubercular molars of such Carnivora as possess them (excepting the plantigrades). In the Ungulates its persistence is to be found in the molars of the Coryphodontidæ of the Wasatch, and Dinocerata of the Bridger Eocenes. In later epochs it is chiefly seen only in the last superior molar.

It is also evident that the quadritubercular molar is derived

from the tritubercular by the addition of a lobe of the inner part of a cingulum of the posterior base of the crown. Transitional states are seen in some of the Periptychidæ *(Anisonchus)* and in the sectorials of the Procyonidæ.—*E. D. Cope.*

Geological Relations of Campbell Island.—M. H. Filhol, in a note read before the Academy of Sciences, Paris, February, 1882, takes occasion to doubt whether this island at any time formed part of New Zealand, as is supposed by some of those who believe in the great extension of the last-named land in recent geological times. M. Filhol does not call in question the existence of a continental New Zealand, but states that Campbell island consists chiefly of a limestone containing Globigerina, and of lavas containing anorthite, and that neither of these rocks occur in New Zealand. The limestone is of deep-sea formation, and the lava must, from the presence of anorthite, be Post-pliocene. The lava was therefore erupted, and the island elevated, at the period when New Zealand possessed its least geographical extension. Moreover, neither moas nor lizards have been found on Campbell island.

The Princeton Scientific Expedition of 1882.—This expedition, consisting of some professors and six students of Princeton College, left Princeton June 26 and remained in the field until September 6th. The object of the excursion was a geological one, and the fields operated in were Chalk bluffs, Colorado, and Bad lands of Dakota. A thousand miles of riding was accomplished, many photographs were taken, and nearly a ton and a-half of fossils, including more than twenty-six genera of mammals and reptiles, were collected for the museum.

Geological News.—*Silurian*—Dr. T. Davidson lists the Silurian Brachiopoda, of Scotland, 134 species, of which sixty-four are recorded from the Llandeilo; forty-four from the Caradoc, forty-seven from the Llandovery, eight from the Wenlock and twenty-eight from the Ludlow.——Dr. Nathorst writes to the *Geological Magazine* to throw doubt upon the "plant-fossils" recently described from the Silurian of Central Wales. With regard to Retiofucus, the vegetable nature of which, according to the describer, cannot be doubted, Dr. Nathorst states that he has seen a similar structure produced by the bursting of foam-bubbles of dirty sea-water upon the beach. These so-called fossils are all described as convex projections from the under side of the grit beds. They cannot therefore, says Dr. Nathorst, be plant fossils, but are for the most part simply *casts* of the depressions made by the trails of animals.——G. R. Vine describes thirteen species of tubicolous annelids from the Wenlock shales, (Silurian), most of them new.——J. E. Marr describes the Cambrian and Silurian rocks of Scandinavia. There is a most important physical break, as indicated by the absence of several beds at the

summit of the Cambrian; and there is a palæontological break, most marked in the deep-water beds.——Professor J. D. Dana writes upon the geological age of the "Taconic system" of the Taconic mountains of New England, and maintains that the Stockbridge limestones are conformable with the central schists.

Carboniferous.—M. Brongniart (*Comptes Rendus*) describes a remarkable Orthopteron of gigantic size, found in blackish shales of Coventry, France. The insect is nine and a-half inches long, and is well furnished with spines. It was probably apterous. Until 1882 only 110 species of insects were known from the Carboniferous rocks of the whole world, none of them from France, but since that date 430 impressions have been obtained from Coventry.——In the Quarterly Journal of the London Geological Society, E. W. Binney writes upon a series of red barren beds overlying the profitable beds of the Fifeshire coal-measures. These beds are higher than any on the east coast of England, and may be the entire or partial equivalents of the upper coal-measures of the western districts. Fish, crustacea, calamites, algæ, etc., occur.—— P. H. Carpenter works out the relationships of the genera Hybocrinus, Bærocrinas, and Hybocystites. The first he regards as a Crinoid of a very embryonic type, the second as a permanent larval form which has only developed three of its five arms, and the last as combining the characters of the Blastoidea with those of the Crinoidea.——W. H. Twelvetrees (*Geol. Mag.*, Aug., 1882), has a note on some reptilian teeth from the upper Permian cupriferous sandstones of Kargalinsk, near Orenburg, Russia, including a canine belonging to an unknown species, a tooth which he probably erroneously supposes to be an incisor of Deuterosaurus, and a curved sabre-like tooth with crenated edges, which the writer suggests may belong to a true Dinosaur. All reptilian Permian remains, hitherto found in Russia, have been Theromorphous.—— Professor Cope recently exhibited at a meeting of the Philadelphia Academy, crania more or less complete, of four species of a genus of Permian Theromorphous Saurians with molar teeth, which he had named *Empedias*. The species are *E. latibuccatus*, *E. phaseolinus*, *E. molaris* and *E. fissus*, sp. nov. The first named approaches the genus *Chilonyx* in the presence of swollen areæ on the top of the skull. The others form a series beginning with *E. phaseolinus* with more numerous, narrower teeth, to *E. fissus* with fewer, wider teeth.

Triassic.—Joaquin Gonzalo y Xavier has communicated to the London Geological Society the discovery of fossils in the metalliferous limestone of the Sierra de Gador, Spain, hitherto a puzzle to geologists. The fossils prove the strata to be Triassic.

Cretaceous—W. Whitaker (*Geological Magazine*) writes of the Red Chalk of Norfolk, which has been variously supposed to belong to

the Chalk, Upper greensand or Gault, or to some combination of these. His conclusion, from palæontological evidence, is that it represents the lowest part of the Chalk, the Upper greensand and the upper part of the Gault.——Mr. Woodward describes a Calamary (*Dorateuthis syriaca*) from the cretaceous of Sahel Alma, near Beirut, Lebanon, Syria. The limestone in which this was found has yielded many other interesting forms, including a Squilla, a Limulus, and several undescribed Crustacea. The pen; arms, short and long; the outlines of the fins, position of the ink-bag, impression of the horny mandibles, and the eyes, can be well seen in the fossil.——Professor Seeley also describes a dinosaurian coracoid found at Brook, Isle of Wight. If this bone pertains to a described genus, it must be to Pelorosaurus or Ornithopsis. It is 17⅓ inches long, and 14¼ wide.

Tertiary—Dr. Manzoni has published a memoir upon the siliceous sponges of the Middle Miocene of Bologna and Modena. The Lithistid and Hexactinellid sponges of some layers are so numerous that these may be regarded as sponge-beds. A remarkable fact is that these sponges occur in a stratum which, from its structure and the included Echinoderms and Mollusca, is proved to be of comparatively shallow water origin.——Professor Owen describes the femur of *Nototherium mitchelli*, an extinct Australian marsupial, probably in some respects intermediate between the wombat and the kangaroo.

Quaternary—Professor Nordenskiöld, on his return from his voyage around Siberia, discovered at Moji, near Nagasaki, Japan, a rich flora of late Tertiary or Post-tertiary age. These plants include about seventy species of trees and shrubs, constituting an assemblage very similar to that which now inhabits the forest regions of the northern portions of Japan, at heights of 4500 to 7000 feet. When this fossil flora grew in the extreme south at the sea-level, the climate must have been colder than now. By far the greater number of the genera now occur in this country, and from eighty to ninety per cent. of the leaves cannot be distinguished from those of *Fagus ferruginea*, to which an existing Japanese beech is very close.——In a late communication to the Geological Society, the Rev. A. Irving brings many arguments against the supposed excavating powers of glaciers. He asserts that the facts show that most of the energy developed is expended within the mass of the glacier in overcoming cohesion, having only a small residuum for erosion, This is borne out also by the absence of ductility and lack of continuity shown by crevasses. Much of the erosion attributed to glaciers is really caused by the direct action of glacier streams. Some basin-like hollows may have been formed by glaciers, but many lakelets occupy hollows formed by earth-movements on the mountain-slopes or by moraines. Among the causes producing

valley-lakes Mr. Irving enumerates *alterations in the relative levels* of different parts of the floor of a valley; *upthrust* of the more yielding strata by the resolution of forces due to pressure of the mountain-masses, and the *crushing in of the floor* by the dead weight of the huge glaciers piled upon it. Faults and chemical solution also played their parts. The writer thought that the greater abundance of lakes in glacial countries was largely due to the better preservation of their basins from silting. In some glaciated regions lakes are wanting.——In the *Geological Magazine* for January, Mr. H. H. Howorth continues his perennial argument in favor of a great Post-glacial flood. He asserts that the number of purely Arctic shells found in the marine drift is comparatively small, while several shells of a southern origin occur, and both are often broken, and clearly not *in situ*. This is the case in Norway and Sweden, as well as in England and Ireland. ——E. L. Jones gives the results of the exploration of two caves near Tenby, Wales. One of these contained remains of the mammoth, rhinoceros, hippopotamus, hyæna, elk, Irish elk, *Bos priscus*, cave lion and cave bear, while all these palæolithic animals were wanting from the other, which yielded the reindeer, red-deer, horse, hog, *Bos longifrons*, and dog or wolf. In the second the remains of a hearth were also found. The first was a palæolithic hyæna-den, the second a neolithic human residence.

General—The long-delayed Geological Record for 1878 has at length appeared. Its editor explains the delay by the non-arrival of the sections on America and the Arctic regions, without which important portions the work has finally been issued. Supplements for 1874-1877 follow each of the main divisions.——Mr. R. P. Whitfield contributes to the Bulletin of the American Museum of Natural History, illustrations of the species previously described in the Trans. Albany Institute, by Professor James Hall, with a revision of the descriptions hitherto published and diagnosis of three new species.——A. M. Waters describes fossil chilostomatous Bryozoa from Mount Gambier, S. Australia, giving notes of sixty-eight species, thirteen of which are new.——J. Milne, in the Transactions of the Seismological Society of Japan, gives some interesting particulars as to the effect of earthquakes upon buildings. Three hundred and seventy earthquakes, occurring from 1872 to 1880 inclusive, gave ample opportunity for such observations. Brick houses in streets running S. W. to N. E. have been much more cracked than those in streets at right angles to this direction. The most and more intense shocks traveled S. E. to N. W. Cracks in buildings which did not lengthen, were yet found by indicators to open and shut, and Mr. Milne discusses the possibility of erecting buildings with joints ready made, so that portions of a structure likely to have different periods of vibration may oscillate independently. Chimneys are, in Yokohama, often built free from the roof for this reason. Arches which

curve into their abutments are less likely to crack than such as join them at an angle. The majority (213) of the shocks came in the winter.

BOTANY.[1]

THE MOVEMENTS OF ROOTS OF INDIAN CORN IN GERMINATION.[2]—In the recent work of the late Charles Darwin on the movements of plants, he says that roots, stems and leaves bend to all points of the compass successively with a sort of rolling motion which he terms circumnutation—a bowing around

The radicle bends away from any irritant, as a small piece of gum paper attached to one side of the tip. "In whatever direction the primary radicle [or root] first protrudes from the seed, geotropism guides it perpendicularly downwards."

I have carefully studied the movements of some 400 or more kernels of sprouting Indian corn of seven or more varieties, and, so far as they are concerned, Darwin's statement is much too strong in regard to geotropism guiding the radicles perpendicularly downwards. If allowed to germinate on a flat, smooth plate, some of the roots will rise and fall as they move along the surface, making a series of curves, others continue to run flat on the surface, others bend the tip of the root against the plate and curve with so much force that the kernel is tipped over. On a piece of thick, wet paper, the root is often slightly obstructed so that it makes a coil and proceeds forward again.

One of my students repeated some of Darwin's experiments by pinning kernels of germinating corn on a cork, over water in a bottle set in a dark place. Pieces of gum-paper were placed on one side of the tips of the roots. In some cases the root was a trifle deflexed from the paper, in others it was not in the least changed in its course. In some cases single coils were made; in one instance a figure 8 was made and a single coil after that, by which the gum-paper was shoved off, when the root went straight on to the water. It was not sensitive to another paper on the tip. Another root almost tied itself into a knot. Young roots were the most sensitive.

I pinned over 300 kernels of germinating corn to small sticks, which were placed over water in a deep pan, and all closely covered in the dark. Seven varieties of corn were used, some of which were fresh; some of which had been grown some years before. No gum-paper or other objects were placed on any of these roots. It seemed to make little difference which side or which edge or end of the kernel was placed uppermost, the results were equally variable, so far as the direction taken by the roots was concerned. In all of the sorts, one or more coils were very common. One root went off without support in a horizontal direction for three

[1] Edited by PROF. C. E. BESSEY, Ames, Iowa.

[2] Notes from papers presented at the Cincinnati and the Montreal meetings of the American Association for the Advancement of Science.

inches, some went obliquely upwards; a few went straight up; some making curves, some one, two or even three coils.

For experiments made in 1882 and reported below, I used good, sound yellow-dent corn, one year old, of one variety. I observed nearly 700 germinating kernels in sandy soil, in various situations. The primary and secondary roots, from one to six for each kernel, about 3000 in all, were examined, and not a single instance was found of a coil in the root. The roots in loose sand generally went onward in one direction without abrupt turns, sometimes wavy, sometimes turning by some obstruction.

I placed some clean, damp sand four inches deep in a cellar facing the north, with the temperature about 65° to 75° F., where the surface of the soil remained slightly moist, without supplying water. The surface of the sand was left loose and level.

Three hundred kernels were planted one-half to three-fourths of an inch deep, all with the tips or embryo end down. When most of the plants were showing green leaves above the sand, none over half an inch, I counted 33 roots out of the sand, mostly secondary roots, I suppose. The tips of these were generally curved down, as if sick of the element they were in, and trying to get back into the sand. Mice and squirrels interrupted this experiment. However, after the plumule was two to four inches high, 150 kernels were examined. At this time, some 200 roots were above the ground, three of which were primary roots. The latter had grown three, four and six inches respectively before coming out to the surface. I examined the shape of the tip of 88 of these primary roots for one inch as they were seen below the surface. Twenty-five were straight, 23 were slightly wavy in two planes, the other 40 were more or less curved near the end.

The roots above the sand were somewhat red. Most of them re-entered the soil after coming out on the surface for one to four inches or more. Some never could get back, although the sand was very loose.

Nearly all the roots grew well on the surface and produced and retained trichomes without any trouble. The roots in the sand usually ran downward obliquely, often about 10° to 30° with the surface, very rarely straight down.

A second lot of 150 kernels acted just about like the first, only they were not disturbed by mice or squirrels.

Again, I planted 181 kernels half an inch deep in the cellar, the tip, or end of the kernel grown next the cob, was placed uppermost and patted well as with a hoe. When the ascending axes were about four inches long the plants were examined.

Of these, 89 sent primary roots out of the sand, 92 did not send the primary roots out of the sand. Seventy-five sent the primary root out and in again, one out andin twice, one out and in three times.

Where the primary root came above the sand in these cases, it

generally came out very soon after germination. In one case it grew four inches before coming out. Eight roots were so near the surface, still below it, that they were red for a foot or more. The primary roots in the experiments had reached the length of ten to fourteen inches, and at that length they were always longer than the secondary roots, even if the primaries had run out of the ground. The roots apparently grew about as well out of the sand as in the sand.

In loose, level, sandy soil in the garden, I put in with thumb and finger 118 moistened kernels of corn, with the tips down, about three-fourths of an inch below the surface. The soil was gently patted down. By the side of these, in a similar manner, I planted 92 kernels with the tips uppermost. The weather during this experiment was clear for most of the time, excepting the day previous to examining the corn. Of the 118 kernels planted with the tips down, all sent the plumule up correctly. Sixteen thrust obliquely upward, one secondary root each, very near the surface, where it died; one thrust up two secondaries, which died. No primaries came to the surface.

Of the 92 kernels planted with the tip end up, all sent out of ground a curved plumule. The primary roots usually turned quickly and went obliquely down, on the average about 30 degrees from the perpendicular. They certainly went more directly down than did those tested in the sand in the cellar. Of the 92 kernels with the tips up, nine sent primary roots out of the ground where they died. This is nearly 10 per cent. The growth of the kernel, however, was maintained by the secondary roots. One kernel only of this lot of corn thrust one secondary above the ground, where it died.—*W. J. Beal, Lansing, Mich.*

A Singular Habit of Psoralea argophylla.—During an extended trip in Dakota the past summer, this plant was a daily companion. So abundant is it that it gives large areas of the prairie a silvery whiteness. In the latter part of August, a hot south-west wind blew for several days, which so blocked the roads in places with the loose "tops" or stems of this plant as to considerably retard a team in traveling, reminding one of similar experience with the "tumble weed" (*Amarantus albus*), and "tickle-grass" (*Panicum capillare*), near cultivated fields after a frost. The fashion followed by these utterly diverse plants, is beautifully adapted for scattering seed over the prairies. They all form, in growing, a spherical bushy top, but their methods in starting on their journey are very different. In the case of the tickle-grass the panicle breaks off at the first joint below. In the "tumble-weed" the root is usually pulled up to complete the lower part of the sphere, the plant usually growing in a loose soil. But the Psoralea growing in a hard turf resorts to the following method: Very near the top of the ground a joint is formed in the stem, as perfect as that for separating a leaf from the stem.

It cuts through all the tissues so that when the top dries up and begins to sway in the wind, it is broken off very readily and evenly. One might perhaps think that the wrenching of the stem was the only cause of the separation, but I satisfied myself that a real joint is formed, by examining plants still green. The bushy top of the Psoralea is higher relatively from the ground than that of the Amarantus, so that it is roughly spherical without the root.—*J. E. Todd, Beloit, Wis.*

WHENCE CAME THE WILD POTATOES OF ARIZONA.—Several years ago August Fendler collected near El Paso, New Mexico, a kind of potato used largely by the Navajo Indians, and which resembled the cultivated potato, except in size; the tubers are not larger than filberts. Dr. Gray named the species for the discoverer—*Solanum Fendleri.* The tubers have been heard of but once since, and that was in 1879, when Dr. Palmer collected a handful that, being sent to the Agricultural Department at Washington, found their way at last into the hands of Prof. Meehan, who planted them, and cultivated them for a few years, when, for no apparent reason, they were lost.

During the summer just past (1882), we discovered a new locality for this species in the Huachuca, New Mexico; also of another species, formerly known from the mountains of Colorado—*S. Jamesii* Torr. The latter, we believe, has never been tested in cultivation, yet it is very promising, for its short stolons and readily improved size of tuber. Both species we found invading the few gardens of the region, seemingly rejoicing in being able to escape the attacks of the gardener by reason of their close resemblance to the genuine *S. tuberosum.* Though found also on the high slopes in the shade, yet they were larger in the gardens. Humboldt shows us that the potato was not known in Mexico at the time of the Incas, while it is now found in various parts of the republic, in a wild, neglected condition.

Now whence came it? Did an immigration subsequent to that of the Aztecs bring this esculent and plant it along the Rio Grande and the Gila? Or is it truly indigenous? Dr. Gray concludes (in his latest works) that the so-called distinct species of *Solanum Fendleri* is only a form of the original *S. tuberosum,* and he arranges it as "*var. boreale* Gray." Also he says of the other plant—*S. Jamesii*—that although "it appears on the whole to be distinct," yet "there are good reasons for suspecting that these two forms, with several others in Mexico, are but varieties of the Peruvian *S. tuberosum.*" If so, why is not their cultivation possible? and why is their source lost? Humboldt argued, in 1812, that if Sir Walter Raleigh's colonists *did* bring the potato from Virginia, it must have been derived from a plant indigenous to the northern hemisphere, and thus he pointed out this discovery nearly a half century afterward. But Dr. Gray argues that the potato

of Virginia must have recently been imported there by Spaniards, for it was not a small, half-sized potato that grew in Sir Walter's garden, but evidently large, attractive tubers, already brought up to size by long cultivation.

Was the potato carried across from the Rio Grande to the foot of the Alleghenies in an early day? and if so, by whom?—*J. G. Lemmon, Oakland, Cal., Jan. 23, 1883.*

P. S.—Tubers of these native potatoes were collected, and, when the spring opens, will be sent out in securely packed parcels of a dozen each, to applicants, addressing J. G. Lemmon, Lemmon Herbarium, Oakland, Cal.

The Number of Species of North American Flowering Plants.—In a paper read last year to the botanists at the Montreal meeting of the American Association for the Advancement of Science, Dr. Gray gave some interesting facts as to the number of species of flowering plants in North America, north of Mexico. According to it, in 1878, the Polypetalæ numbered 3038, and the Gamopetalæ after Compositæ 1656 species. Adding the increase of four years, Dr. Gray estimates that these two alone must reach "about 5000 species." He further estimates that these "must make up half our phænogamous botany," so that upon this basis we should have for the whole at least 10,000 species. The great increase in the number of Compositæ, will probably carry the number somewhat higher than this; and when we add the introduced species (which already reach no small number) "the 10,000 species of this estimate may before long rise to eleven or twelve thousand."

Note on the Vitality of Senecio scandens.—A thrifty vine of German Ivy was trained upon the sides and top of a large room. The stems were perhaps over fifteen feet in length. On the first day of last June it was removed, with the exception of two pieces five or six feet long, which were left hanging upon strings at the top of the room. These seemed unconscious that they were cut off from their base of supplies, and continued green, and one grew several inches. The terminal end of this was taken down November 1st, and is now growing vigorously in a pot of earth. The other branch left undisturbed remained green, a portion of it, till about New Years. The room was used as a study, and was occupied most of the time.—*J. E. Todd, Beloit, Wis. Feb. 5, 1883.*

Botanical Notes.—The article "Botany" by J. C. Arthur, in the History of Floyd county, Iowa, is a model of what such an article should be. It includes brief general notices of the lower as well as the higher plants. A page is given to the sexless plants (Protophyta); another page to the unisexual plants (Zygosporeæ); half a page to the egg-spore plants (Oösporeæ); two pages to the mushrooms and their allies (Carposporeæ); a para-

graph to the mosses and liverworts (Bryophyta), and another to the ferns and their allies (Pteridophyta); with four pages to the seed-bearing plants (Phanerogamia).——Forestry Bulletin, No. 18, gives the fuel values of fifty-five of the more important woods of the United States. The first five on the list are (1) *Cercocarpus ledifolius*, (2) *Pinus australis*, (3) *Carya alba*, (4) *Quercus prinos*, (5) *Pinus rigida*.——Forestry Bulletins, 19, 20 and 21, contain maps showing the forest areas of California, Oregon and Washington Territory. Of the latter the remark is made that "west of the Cascade mountains it is covered by the heaviest continuous belt of forest growth in the United States." Of this the "red or yellow fir" (*Pseudotsuga douglasii*) known in the East as the Douglas spruce, forms "about seven-eighths of the forest growth." ——Henry Trimen in the Dec. number of the *Journal of Botany* announces his withdrawal from that periodical, declining "to risk any further loss." James Britten, the well-known editor, has bravely "determined to carry on the journal" at his own risk "for at least another year," and appeals to its friends for aid in obtaining additional subscribers. Cannot American botanists do somewhat towards aiding Mr. Britten in his laudable attempt to keep alive this old and valuable journal. Subscriptions (twelve shillings) should be sent to the publishers, West, Newman & Co., 54 Hatton Garden, London, E. C., England.——In contrast with the foregoing, it is gratifying to note the steady growth of the *Botanical Gazette*, now entered upon its eighth year, enlarged and greatly improved. It is upon a good footing, financially, and Professor Coulter is to be congratulated upon the assured success of his undertaking. The addition of Professor C. R. Barnes and Mr. J. C. Arthur to the editorial force will doubtless enable the *Gazette* to make still further improvement.——Davis L. James has republished in the Jour. Cinn. Soc. Nat. Hist., the descriptions of new species of Fungi collected in the vicinity of Cincinnati, by Thomas G. Lea, and described by Rev. M. J. Berkeley. The original, published in 1849, has long been so rare as to be practically inaccessible to all but a very few students. Descriptions are given of fifty-three species; of these twenty-three are noted as having been described also in *Hooker's Jour. Bot.*, Vol. IV.——Dr. Goodale, of Harvard University, has recently imported from Germany a large quantity of apparatus for making experiments and investigations in vegetable physiology. A new laboratory for physiological work is to be erected just back of the present row of buildings at the Botanic Gardens.

ENTOMOLOGY.[1]

THE FOOD RELATIONS OF THE CARABIDÆ AND COCCINELLIDÆ.—Professor S. A. Forbes, State entomologist of Illinois, has just published a valuable paper entitled, "The food relations of the

[1] This department is edited by Professor C. V. RILEY, Washington, D. C., to whom communications, books for notice, etc., should be sent.

Carabidæ and Coccinellidæ," in Bulletin No. 6, Illinois State Laboratory of Natural History, Jan., 1883. He correctly remarks that " observations of the food of these beetles have hitherto been left almost wholly to chance, and have nowhere been systematically pursued—from which it has resulted that we know their habits only in the most conspicuous situations, and have not a fair idea of the general average of their food."

Such systematic observations based on microscopic examinations of the contents of the alimentary canal, have been pursued by Professor Forbes since 1880, and we have already alluded to some of the results (see AMERICAN NATURALIST for April, 1881, pp. 325–326). This latest contribution contains interesting, suggestive and carefully arranged facts, and we have room only to indicate the chief results.

As to the Coccinellidæ, of which thirty-nine specimens were dissected, representing four genera and seven species, the results show that considering the different conditions under which the specimens were obtained, the food seems to be remarkably simple and uniform. It varies but little in the different genera, and consists almost wholly of spores of lower cryptogams, pollen grains and plant-lice, Treating the thirty-nine specimens as a whole, it was found that their food was thirty-seven per cent. animal (thirty per cent. of which consists of insects) and sixty-three per cent. vegetable (fourteen per cent. of this consisting of pollen of grasses and Compositæ, four per cent. of spores of lichens, and not less than forty-five per cent. of spores of fungi).

Professor Forbes concludes " that the data derived from the thirty-nine specimens here discussed, will be found sufficient for a correct general food of the family under ordinary circumstances." The similarity in structure of the mouth-parts throughout the whole family, seems to be a proof of this generalization.

The food question in the Carabidæ is more complicated. The general table shows that the food of Calosoma, Pasimachus, Scarites and Brachinus (only one specimen examined) is composed wholly of animal matter, while in Harpalus and Anisodactylus[1] the animal matter represents respectively only twelve and twenty-one per cent. These two abundant genera, Professor Forbes remarks, can hardly be classed as carnivorous insects at all, and Amara should probably also be placed in the same category. Other genera are intermediate between the two extremes. " If we now look to the structure of these beetles for some explanation of their differences of habit, we shall find corresponding variations in the form and structure of the mandibles. Where the mandibles are long and curved, and are destitute of basal molar processes, but are provided at or near the middle of the cutting edge with processes relatively long and sharp, the beetle seems to feed substan-

[1] Amphasia, which has the lowest percentage of animal food, viz., seven per cent., is now included in Anisodactylus.

tially upon soft or liquid animal food [*e. g.*, Calosoma]. If they are of medium length, somewhat slender, broad at base and tapering distally, with the tip acute, and provided with basal processes which are not especially prominent or sharp, the food is chiefly animal, but solid structures are masticated and swallowed, and some vegetation appears in the alimentary canal [*e. g.*, Chlænius]; while finally, if they are short and quadrate, blunt at the tips, and provided either with strong basal processes or broad opposed surfaces, vegetable food is found to predominate" [*e. g.*, Anisodactylus].

The nature of the food taken by the Carabidæ is also much more varied than in the Coccinellidæ, the animal food including mollusks (slugs) and insects of all orders, while the vegetable food is composed of seeds (the graminaceous plants furnishing by far the greatest percentage), pollen and spores of lichens and fungi. Considering the 117 specimens which were dissected we find that, as a whole, their food consisted of fifty-seven per cent. of animal food and forty-three per cent. of vegetable food.

Relations of the Carabidæ and Coccinellidæ to Birds.— Not less interesting than the above generalization are those made by Professor Forbes in the same paper on the relation of these two families to birds. The Coccinellidæ were not taken at all by the feathered tribe, and the Carabidæ seem to be eaten in proportion as they have phytophagous habits. He gives the following summary:

"It will be seen that there is a very wide difference between the number of Carabidæ proper taken by these birds, and the number of Harpalidæ, representatives of the former group occurring in only six specimens, and of the latter in 116. On the other hand, fifty-nine of the birds had taken Harpalids, which may be fairly classed with the second group established in this paper [those which take a much larger ratio of animal than of vegetable food, but masticate and swallow it], and fifty-seven had taken those belonging to the third group, or phytophagous Carabidæ. The genera most preyed upon are Harpalus, taken by twenty-eight of the birds, Anisodactylus by eighteen, Agonoderus by fourteen, Cratacanthus by thirteen, Pterostichus by twelve, and Evarthrus by eleven; numbers which represent fairly well the relative abundance of individuals taking the entire season through. We note, however, a remarkable deficiency of the highly-colored genera, such as Galerita, Brachynus, Lebia, Platynus, Chlænius, etc., which are either absent or found but rarely in these birds' food. Evidently these more showy beetles are protected by some more effective means than obscurity of color."

Phylloxera Laws.— Belgium has lately entered the list of states which have adopted the rules of the International Convention of Berne relative to the prevention of Phylloxera ravages.

These rules prohibit the importation and transit, through Belgium, of vines, cuttings, etc., from infested districts, but allow their importation from non-infested districts subject to special authorization from the Minister of the Interior. Importation of garden produce, cereals, fruit and cut-flowers is not affected by these rules, but all other plants, shrubs and vegetables can only be admitted through the custom-houses and upon very stringent specified conditions.

Fostering the study of Economic Entomology. — France does more for the promotion of economic entomology than any other country in Europe, as might be expected from a country whose main source of revenue, the grape vine, is so dangerously threatened by the Phylloxera, and which derives so much wealth from the cultivation of the silk-worm. The latest step is, as we learn, the donation of a plot of land by the city authorities of Paris for a school of "insectology" (to literally translate the bastard term that has of late come into use there) to be founded by the Société Centrale d'Agriculture et d'Insectologie. An experimental apiary, a silk nursery, and a mulberry plantation have already or are to be constructed in connection with this school; while a museum of useful and noxious insects, of insectivorous animals, etc., will help to illustrate the lectures to be held in the new school.—*C. V. R., in Rural New Yorker.*

Viviparity in a Moth.—At a recent meeting of the London (Eng.) Entomological Society, a small moth was exhibited which had been received, from Dr. Fritz Müller, from Brazil. It possessed an exceptional interest from the fact that it was viviparous, having been seen by Dr. Müller to deposit living larvæ.

Damage to Silver Plate by Insects.—Specimens of *Niptus hololeucus* have been received by Lord Walsingham from Scotland, said to have damaged silver plate, there being holes in the plate on which the insects were found. The corrosive property probably existed in the fœces.

The Hibernation of Aletia xylina, Say, in the United States, a settled fact.[1]—I have already shown in previous remarks before the association that there were various theories held by competent men—both entomologists and planters—as to the hibernation of this Aletia (the common cotton-worm of the South); some believing that it hibernated in the chrysalis state, some that it survived in the moth state, while still others contended that it did not hibernate at all in the United States. I have always contended that the moth survived within the limits of the United States, and in this paper the fact of its hibernation, principally under the shelter of rank wire-

[1] Abstract of a paper read by C. V. Riley before the American Association for the Adv. of Science, at the Montreal meeting.

grass, is established from observations and experiments made during the winter and spring of 1881–2. The moth has been taken at Archer, Fla., during every winter month until the early part of March, when it began to disappear, but not until eggs were found deposited. The first brood of worms was found of all sizes during the latter part of the same month on rattoon cotton, while chrysalides and fresh moths were obtained during the early part of April.

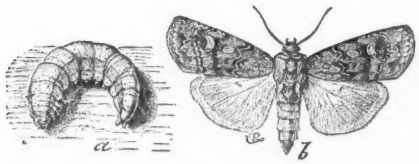
The fact thus established has this important bearing:

"Whereas upon the theory of annual invasion from some exotic country there was no incentive to winter or spring work looking to the destruction of the moths, there is now every incentive to such action as will destroy it either by attracting it during mild winter weather by sweets, or by burning the grass under which it shelters. It should also be a warning to cotton-growers to abandon the slovenly method of cultivation which leaves the old cotton-stalks standing either until the next crop is planted or long after that event; for many planters have the habit of planting the seed in a furrow between the old rows of stalks. The most careful recent researches all tend to confirm the belief that Gossypium is the only plant upon which the worm can feed in the South; so that in the light of the facts presented there is all the greater incentive to that mode of culture which will prevent the growth of rattoon cotton, since it is questionable whether the moth will survive long enough to perpetuate itself upon newly sown cotton except for the intervention of the ratton cotton."

Possible Food-plants of the Cotton-worm.—In connection with the above abstract we are prompted to return once more to the subject of the food-plants of Aletia, by a very interesting note from Dr. J. S. Bailey in *Papilio* for December, 1882. He records the appearance of the moth at sugared trees on October 7th and 8th, 1882, near Karner, N. Y. On the first evening a crippled specimen was observed crawling up the sugared tree, while on the following evening one specimen appeared which evidently had just hatched from the chrysalis, and was shaking out its wings while ascending the tree. The other specimens of Aletia attracted by the bait were all of them bright and fresh. These facts observed by such a careful and trustworthy lepidopterist as Dr. Bailey, accord with the conclusions we arrived at in discussing the subject in the April (1882) number of this magazine (p. 327), and seem to us to conclusively prove that Aletia had passed at least one generation outside of the cotton belt, and that the larva must have fed upon some yet unknown plant different from Gossypium. It is to be regretted that Dr. Bailey failed to ascertain this food-plant of Aletia in the Northern States, because from the facts given by him, there can be little doubt that it was only a few steps away from the sugared tree. Traces of

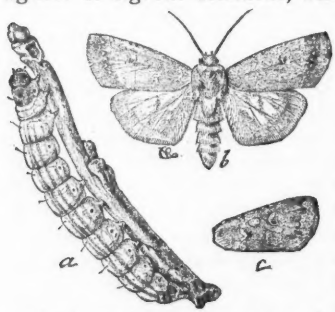
the work of the larva or the empty chrysalis wrapped up in the leaves might perhaps even yet be found.—*C. V. Riley.*

AGROTIS MESSORIA Harr. vs. AGROTIS SCANDENS Riley—In *Papilio* (Vol. I, No. 8) Mr. A. R. Grote remarks that *Agrotis messoria* Harr. may be *Agrotis scandens* Riley. We have shown that the two bear no resemblance to each other, but that *A. messoria* is *A. cochranii* Riley, and that *A. repentis* G. & R., and *A. lycarum* Gr. are conceded synonyms (*Papilio*, Vol. II, p. 41). In the new "Check-list of N. A. Moths," Mr. Grote properly makes *repentis* a synonym of *cochranii*, though he had previously given the former precedence. This last is, however, still retained as distinct from *messoria*, the types of which have confessedly never been examined by him. Yet, the identification of *messoria* is established by careful examination of Harris's types, both by myself and Mr. H. K. Morrison. Unfortunately, this instance of the rejection of the evidence of other entomologists when it conflicts with his own is not exceptional; it is rather characteristic of Mr. Grote's work.



Agrotis messoria, *a.* larva; *b.* moth. (After Riley.)

We introduce a figure of the species. In our first Missouri Entomological Report, it was shown to greatly injure, in the larva state, the buds of fruit trees, and especially of apple, pear and grape-vines. We also reproduce from the same report, figures of *Agrotis scandens*, which in the larva state has somewhat similar habits, in order to show the great difference between the two species, both in the larva and imago states. The colors in *messoria* are of a warm gray, with brown and smoky marks and shadings; in *scandens* they are a delicate pearly, pale, bluish-gray, with faint ferruginous-brown marks and a dusky spot on the reinform. The markings, as shown in the figures, are totally different in the two species, and no two species of the genus are more easily separated.



Agrotis scandens; a. larva; *b.* moth, normal form; *c* wing of dark var. (After Riley.)

AN INTERNAL MITE IN FOWLS.—Professor Thomas Taylor, microscopist of the Department of Agriculture had occasion recently to dissect a sick chicken, and he found that all parts of

the lungs, the bronchia and the linings of the thorax and abdominal cavities were covered more or less thickly with a mite. An examination we were requested to make showed it to be in all respects identical with *Cytoleichus sarcoptoides* Mégnin. This parasite is known in Europe to inhabit the air passages of gallinaceous birds, giving the transparent and membranous linings of these passages the appearance of gold-beater's skin speckled with flour. It is likewise found in the bronchial tubes and their divisions, and even in the bones with which the air sacs communicate. Mégnin believes that while the mite may be extremely numerous, so as to cause mucous irritation and induce asphyxia and congestion by obstruction of the bronchia, and that birds may thus die, yet it is incapable of causing, as Gerlach and Zundel believe, enteritis or inflammation of the peritoneum.

Prevalence of the Screw-worm in Central America.—Although not containing anything new the following portion of a letter from Mr. Jose C. Zeledon of San Jose, Costa Rica, recently addressed to Professor S. F. Baird, will be found of some interest: "I have mailed to you, to-day, a little box containing a good many specimens of Lucilia (perhaps two or three different species), which I hope will be of some service to Professor Riley in studying your species. Flies of this group are abundant throughout this country at all seasons of the year, but it is on the coast regions where they are particularly common, and there they constitute a very serious annoyance to cattle raisers, the larvæ becoming active in a few hours, owing to the high temperature of the lowlands."

The box contained several hundred flies, the large majority of which proved to be *Lucilia macellaria*, which is also the parent of the screw-worm in the United States.

Dried Leaves as food for Lepidopterous Larvæ.—Lepidopterists engaged in raising larvæ will be interested in a note by Mr. A. H. Mundt, of Fairbury, Ill., published in *Papilio* for January, 1883, giving his experience in feeding caterpillars with dried food. He gathers the leaves in summer, pressing them quite dry like botanical specimens, and before using them as food he soaks them one night in fresh water. This experiment was successfully tried with the larvæ of *Papilio cresphontes* and *Apatura clyton*. Mr. Mundt adds that the dried leaves must be kept in the dark in order to preserve the green color and the flavor. This experience with preserved food may prove equally useful for other species, and promises to be of great advantage in raising larvæ on food to be obtained from distant sections. We have never tried this method of curing leaves, though we have successfully used pressed fresh leaves, mailed and kept in tight tin boxes. In this way we have fed larvæ for weeks, in Washington, on food obtained in Florida. If "hay-making" should prove as successful

as Mr. Mundt's experience would indicate, we would recommend as a possible improvement in the curing and retention of the nutritive properties, the chopping of the leaves, which will permit of more rapid curing and more convenient packing.—*C. V. R.*

LEPIDOPTEROLOGICAL NOTES.—The activity lately displayed by our lepidopterists in making known through the columns of our entomological periodicals the earlier states of Lepidoptera, is very gratifying. Authors should, however, avoid the duplication of descriptions of larvæ and especially of such species as have been fully described in publications that are of easy access. There can be nothing gained by such duplication, especially where the subsequent description is less accurate than the original one.—— Mrs. C. H. Fernald has published in *Papilio* for January, 1883, a list of the Noctuidæ taken in Orono, Me., and vicinity. Such lists, when, as in this case, they are sufficiently complete to indicate the character of the fauna, and reliable as to the determination, are very useful.

OBITUARY.—The entomologists of this country, as well as of Europe, will regret to learn of the death of Mr. G. W. Belfrage, on December 7, 1882, at Clifton, Bosque county, Tex. If the insect fauna of Texas is, at the present time, better known than that of most of the other Western States of this continent, it is largely due to the skill and industry of Mr. Belfrage and the late Mr. Jacob Boll, who were foremost among the few really careful and conscientious collectors in the country. The number of new and interesting species discovered by Mr. Belfrage is really astonishing, considering that they were collected in a very limited area of the State, and several of his discoveries were named after him by our most prominent entomologists. The care and neatness he exhibited in preserving and preparing his specimens, as well as the honesty with which he filled the orders of his numerous correspondents, deservedly procured him a reputation as a collector which extended far beyond the limits of this country.

Professor F. W. Mæklin died January 8th of this year at Helsingfors, Finland, at the age of sixty-one years. He was known to American coleopterists by his papers on Strongylium and Statira, and by his descriptions of a large number of Coleoptera (mostly Staphylinidæ) from the extreme north-western portions of our country. One of his earlier and little known papers, a dissertation on representative (vikarierande) forms among Northern Coleoptera (published in Swedish language, Helsingfors, 1855) is quite interesting to American coleopterists, and was translated into German by F. von Sacken in the Stettiner Entomologische Zeitung for 1857.

ZOÖLOGY.

THE MOST REMARKABLE MOLLUSCAN FORMS TAKEN OFF THE SOUTHERN COAST OF NEW ENGLAND IN 1882.—Professor A. E. Verrill notes the discovery of a cephalopod of the genus Abralia, a genus not before known to occur upon the American coast. Other interesting Cephalopoda were a *living* example of *Argonauta argo*, taken with a dip-net while on the surface; *Eledone verrucosa* at 700 fath., and the second known specimen of the large *Rossia megaptera* V. in 640 fath.

Among the gastropods added to our fauna were the new *Trophon lintoni* V. and Sm., from seventy fathoms; and four Chitonidæ. Of these *Placophona atlantica* V. and Sm., belongs to a genus before supposed to be exclusively Australian. *Choristes elegans* was found in old skates' eggs, and in the same situation occurred *Cocculira banii* and *Addisonia paradoxa*, the latter of which was taken several times in from 89 to 640 fathoms.

Dolium bairdii was taken in 192 fath., and at 349 fathoms two living examples of *Mytilimeria flexuosa* were brought up, associated with *Pecchiola gemma* V., also living. *Axinopsis orbiculata* Sars., was taken in 202 fath.; *Modiolavia polita* V. and S., in 321 fath., and *Cavolina longirostris* in 321 fathoms.

Pteropods were comparatively scarce, and the large Salpa, so abundant in former seasons, was only met with on one occasion. The smaller *Salpa cabotii* occurred in large numbers.

On the sands of Naushon, Hadley harbor, were procured several living examples of *Tellimya ferruginosa*, a European shell not before found on our coast, associated at low-water mark with living *T. (Montacuta) bidentata*, *Corbula contracta*, etc.

From work with surface nets, in Vineyard sound, the veligers of *Anachis avara*, *Astyris lunata*, *Triforis nigrocincta*, etc., were identified.

About twenty forms of gastropod veligers were taken in all.

MIGRATION OF ANIMALS THROUGH THE SUEZ CANAL.—*Nature* states that Professer Keller, of Zurich, during a stay at the Suez canal last winter, studied the animal migrations of which it has been the cause, and found that, since 1870, *Umbrina cirrhosa* and *Labrax lupus* have passed from the Mediterranean to the Red sea, accompanied by *Balanus miser*, *Solen vulgaris* and *Ascidia intestinalis*. A Sphæroma, and the mollusks *Solen vagina* and *Cardium edule* are on their way through.

On the other hand, several fishes, including *Pristipoma stridens* and *Crenidens forskali*, with the mollusks *Cerithium scabridum*, *Mactra olorina* and *Mytilus variabilis*, have passed from the Red sea to the Mediterranean, and quite a "caravan" of other forms is resting in the basins of the great Bitter lakes.

The fauna of the canal is as yet too poor to tempt rays, cuttlefishes and other carnivorous animals.

as Mr. Mundt's experience would indicate, we would recommend as a possible improvement in the curing and retention of the nutritive properties, the chopping of the leaves, which will permit of more rapid curing and more convenient packing.—*C. V. R.*

LEPIDOPTEROLOGICAL NOTES.—The activity lately displayed by our lepidopterists in making known through the columns of our entomological periodicals the earlier states of Lepidoptera, is very gratifying. Authors should, however, avoid the duplication of descriptions of larvæ and especially of such species as have been fully described in publications that are of easy access. There can be nothing gained by such duplication, especially where the subsequent description is less accurate than the original one.—— Mrs. C. H. Fernald has published in *Papilio* for January, 1883, a list of the Noctuidæ taken in Orono, Me., and vicinity. Such lists, when, as in this case, they are sufficiently complete to indicate the character of the fauna, and reliable as to the determination, are very useful.

OBITUARY.—The entomologists of this country, as well as of Europe, will regret to learn of the death of Mr. G. W. Belfrage, on December 7, 1882, at Clifton, Bosque county, Tex. If the insect fauna of Texas is, at the present time, better known than that of most of the other Western States of this continent, it is largely due to the skill and industry of Mr. Belfrage and the late Mr. Jacob Boll, who were foremost among the few really careful and conscientious collectors in the country. The number of new and interesting species discovered by Mr. Belfrage is really astonishing, considering that they were collected in a very limited area of the State, and several of his discoveries were named after him by our most prominent entomologists. The care and neatness he exhibited in preserving and preparing his specimens, as well as the honesty with which he filled the orders of his numerous correspondents, deservedly procured him a reputation as a collector which extended far beyond the limits of this country.

Professor F. W. Mæklin died January 8th of this year at Helsingfors, Finland, at the age of sixty-one years. He was known to American coleopterists by his papers on Strongylium and Statira, and by his descriptions of a large number of Coleoptera (mostly Staphylinidæ) from the extreme north-western portions of our country. One of his earlier and little known papers, a dissertation on representative (vikarierande) forms among Northern Coleoptera (published in Swedish language, Helsingfors, 1855) is quite interesting to American coleopterists, and was translated into German by F. von Sacken in the Stettiner Entomologische Zeitung for 1857.

ZOÖLOGY.

THE MOST REMARKABLE MOLLUSCAN FORMS TAKEN OFF THE SOUTHERN COAST OF NEW ENGLAND IN 1882.—Professor A. E. Verrill notes the discovery of a cephalopod of the genus Abralia, a genus not before known to occur upon the American coast. Other interesting Cephalopoda were a *living* example of *Argonauta argo*, taken with a dip-net while on the surface; *Eledone verrucosa* at 700 fath., and the second known specimen of the large *Rossia megaptera* V. in 640 fath.

Among the gastropods added to our fauna were the new *Trophon lintoni* V. and Sm., from seventy fathoms; and four Chitonidæ. Of these *Placophona atlantica* V. and Sm., belongs to a genus before supposed to be exclusively Australian. *Choristes elegans* was found in old skates' eggs, and in the same situation occurred *Cocculira banii* and *Addisonia paradoxa*, the latter of which was taken several times in from 89 to 640 fathoms.

Dolium bairdii was taken in 192 fath., and at 349 fathoms two living examples of *Mytilimeria flexuosa* were brought up, associated with *Pecchiola gemma* V., also living. *Axinopsis orbiculata* Sars., was taken in 202 fath.; *Modiolavia polita* V. and S., in 321 fath., and *Cavolina longirostris* in 321 fathoms.

Pteropods were comparatively scarce, and the large Salpa, so abundant in former seasons, was only met with on one occasion. The smaller *Salpa cabotii* occurred in large numbers.

On the sands of Naushon, Hadley harbor, were procured several living examples of *Tellimya ferruginosa*, a European shell not before found on our coast, associated at low-water mark with living *T. (Montacuta) bidentata*, *Corbula contracta*, etc.

From work with surface nets, in Vineyard sound, the veligers of *Anachis avara*, *Astyris lunata*, *Triforis nigrocincta*, etc., were identified.

About twenty forms of gastropod veligers were taken in all.

MIGRATION OF ANIMALS THROUGH THE SUEZ CANAL.—*Nature* states that Professer Keller, of Zurich, during a stay at the Suez canal last winter, studied the animal migrations of which it has been the cause, and found that, since 1870, *Umbrina cirrhosa* and *Labrax lupus* have passed from the Mediterranean to the Red sea, accompanied by *Balanus miser*, *Solen vulgaris* and *Ascidia intestinalis*. A Sphæroma, and the mollusks *Solen vagina* and *Cardium edule* are on their way through.

On the other hand, several fishes, including *Pristipoma stridens* and *Crenidens forskali*, with the mollusks *Cerithium scabridum*, *Mactra olorina* and *Mytilus variabilis*, have passed from the Red sea to the Mediterranean, and quite a "caravan" of other forms is resting in the basins of the great Bitter lakes.

The fauna of the canal is as yet too poor to tempt rays, cuttlefishes and other carnivorous animals.

All this has taken place in spite of the lakes, of the sandy nature of the ground, of the currents, of the disturbance of the ova and larvæ caused by the passage of ships, and of the too great saltness of the canal water.

MANUAL OF THE SPONGES.—It will be remembered that a general work on the sponges appeared in 1859, as the first volume of Bronn's Thierreich. It included the Protozoa and sponges. It is now announced that a new work on the sponges for this series is to be prepared by Dr. Vosmaer, and the first number on the Porifera has lately appeared. Our knowledge of the sponges has been revolutionized within a decade and such a work is much needed.

THE AFFINITIES OF TETRAPLATIA VOLITANS.—*Tetraplatia volitans* Busch, has been shown by Krohn (Arch. f. Naturg., 1865, and Claus., Arch. f. Mikros. Anat., 1878) to be related to animals placed among the Hydrozoa, but its closer relationships are problematical. Its affinities with certain craspedote Medusæ are close (Leuckart, Arch. f. Naturg. 1878; Haeckel, Das System der Medusen). Are there not also structural features of the Ctenophora? The wings of Tetraplatia, although four in number, may be homologized with the lobes of Ocyroë. The diverticula from the stomach occupy a relationship to the other organs in some respects similar to those of the young Mnemiopsis. The otocysts of Tetraplatia have no resemblance either in character or position to the otocysts of the Ctenophores. It seems possible that Tetraplatia, if an adult, as there is probably no doubt is the case, is an intermediate form between the craspedote Medusæ and the Ctenophores, and has affinities with both. The "*Ctenophora tentaculata*" have as close relationships with it through the genus Ocyroë as with the hydroid Medusa, Ctenaria, from which they are supposed by some authors to have been derived.—*J. Walter Fewkes.*

OCCURRENCE OF ALAURINA IN NEW ENGLAND WATERS.—Among the Rhabdocœlous Turbellaria the genus Alaurina resembles on the one side the Cestodes, and on the other has been mistaken for an Annelid larva on account of the peculiar segmented (?) body. A worm belonging to this genus, more closely related to *A. prolifera* Busch, than to a *A. composita* Metsch., is one of the common Turbellarians of Narragansett bay, and is taken almost every summer by those working in the laboratory at Newport. The absence of this highly interesting genus from most, if not all, of our faunal lists has led me to write this note. The only other locality from which it is recorded is that in which it was discovered, viz: Malaga. The resemblance of my drawings of the Newport Alaurina to the figures of this genus by Busch and Metschnikoff was pointed out to me by Mr. W. A. Silliman.—*J. Walter Fewkes.*

LIMAX MAXIMUS IN CENTRAL MASSACHUSETTS.—In the February number of the NATURALIST, I see some interesting notes in *Limax maximus* L. Springfield, Mass., must be added to the localities there given. You will find a note by me in Vol. II. of *Science*, page 278, giving an account of a specimen found in the city aqueduct.—*J. H. Pillsbury.*

TULLBERG ON THE STRUCTURE OF THE SHELL OF CRUSTACEA AND MOLLUSKS.—This is an elaborate treatise on the structure and mode of growth of the lobster's shell, and of the shells of the mussels Mytilus, Modiolus, the pearl mussel and the oyster, as well as some univalve shells, Buccinum, etc. Led at first to study the chitinous parts and epidermis, Dr. Tullberg then extended his examination to the shell-structure itself. The treatise is exhaustive, and the twelve plates are carefully drawn. It was published in German at Stockholm in 1882, in the Transactions of the Royal Swedish Academy. It is too lengthy for abstract.

WRIGHT'S AMERICAN PARASITIC COPEPODA—This brochure, with two plates, is the first of a series of notes on the parasites of some of our fresh water fishes which appears in the Proceedings of the Canadian Institute, Vol. I, No. 3. The new forms are described and figured in detail. Several European forms are identified.

SUPPOSED ORIGIN OF THE SPECIES OF OCYPODA FROM THE BONIN ISLANDS.—Mr. Ishikawa, judging from his article in the February number of the NATURALIST, is not familiar with the animals of the genus (or of the class) in which he is quite certain he sees "specific differentiation going on before our eyes." The forms of Ocypoda which he figures are not, as he supposes, closely allied to our American *D. arenaria*, but belong to two species very different from Arenaria and from each other; and neither his figures nor the descriptions make it at all clear that he has found any "stepping stones" between them, Of the forms roughly figured on the plate accompanying the article, the one at the bottom (the figures are not numbered, lettered or referred to in the text) is apparently *O. cordimana*, while all the others are ordinary variations of *O. ceratophthalma*, and both of these species are well known and common Pacific ocean forms. The species of Ocypoda vary greatly according to age, and are subject to considerable individual and sexual variations. The ocular stylet is known to be wanting in the very young of *O. ceratophthalma*, to vary greatly with the size of the individual, and to be subject to much individual and sexual variation. The form, figured by Mr. Ishikawa, with very long ocular stylets, is the adult of this species, and those with shorter stylets are apparently young individuals of different ages.

The species of Ocypoda and their variations have been recently discussed by De Man, Kingsley and Miers, and familiarity with their papers, or any well directed attempt to discover real specific

differences, would undoubtedly have saved Mr. Ishikawa from useless speculation. His want of familiarity with the subjects of of his speculation is further shown in the description of the sixth somite of the abdomen, and of the "entire" and "whole abdominal somite" (by which apparently he intends to indicate the abdomen itself).—*S. I. Smith, Yale College.*

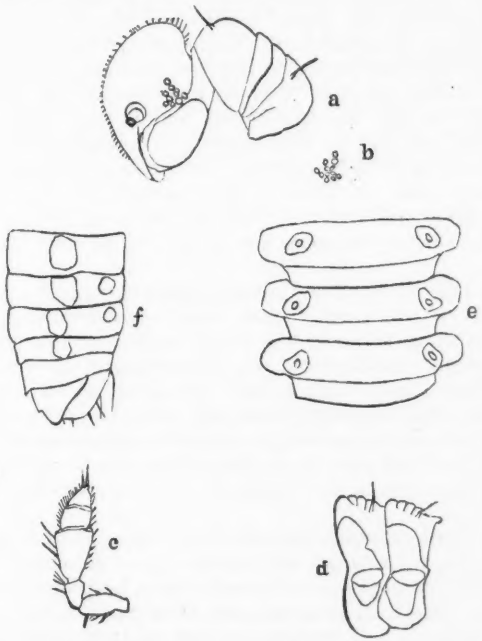
CHELYDRA VERSUS UNIO.—One day last June I came upon a snapping turtle in a peculiar predicament. There was clinging to its lower jaw a clam, which, though they were several rods from the river, was still apparently alive. Without disengaging them I brought them home and put them in a small box, intending to see how the contest would end. I kept them between two and three days, and they remained in the same condition. The turtle's frequent and vigorous attempts to push off the clam with its forelegs proved unavailing. At length the turtle, by some misplacing of the box, made good his escape, carrying off the clam with him. The turtle was about a foot in length and the clam about three inches. The clam could not be expected to live very long out of the water, and the turtle would not be very comfortable in the water, with the water forcing its way down his throat. The occasional attempts of the turtle to go into the water would give the clam from time to time a new lease of life. The clam was probably *Unio complanatus.—F. E. Todd, Beloit, Wis., Feb. 27, 1883.*

A NEW SPECIES OF POLYDESMUS WITH EYES.—The species of Polydesmus, a genus embracing some of our most common Myriopods, are, as a rule, eyeless. We know of no North American species except the one under consideration, which has eyes. Gervais (Aptères) says of the family Polydesmidæ: "Les yeux manquent presque constamment;" Wood in his Myriapoda of North America speaks of the "absence of eyes in this family." Humbert in his "Myriapodes de Ceylon," remarks of the family Polydesmidæ: "Yeux manquant le plus souvent," while of the genus Polydesmus he says "Pas de yeax" Hence the present species is an exceptionable form, though the characters in general are such as not perhaps to warrant a separation from the genus. The specimens were collected by the writer at Portland, Oregon.

The species may be called *Polydesmus ocellatus.* The body is small, rather short, somewhat spindle-shaped, and unusually cylindrical. There are twenty-nine segments behind the head; the scuta are provided with the usual prominent lateral ridges. There is a row of dorsal setæ on each side of the median line; the surface of the scutes is finely granulated. The sides (genæ) of the head are full and swollen, somewhat wider than the first scute but about as wide as the body behind. Ocelli 12–13 in number, conspicuous and black. Antennæ with joint 4 half as long as 3, joint 5 remarkably thick, increasing in thickness to the end, longer than

joint 6 and 7 taken together. Joint 6 not quite so long as thick; joint 7 small, conical; broad at base where it is nearly as thick as the 6th; the joints rather setose; there are two terminal flattened sense-setæ on the tip of the 7th joint. The end of the body is moderately blunt, with four setæ on each side of the last segment (anal valves). It is of a pale horn color. Length 4^{mm}.

This aberrant form would not at first be regarded as a Polydesmus, but would be easily mistaken for a Trichopetalus. The individuals were mature, or nearly so, as they were horn-brown. In the cylindrical body and thick antennæ it approaches *Polydesmus cavicola* Pack., from a cave on the shores of the Great Salt lake. It differs from that species, which is eyeless, in the fusiform body, much thicker antennæ, and the finer granulations as well as the larger number of segments.



Polydesmus ocellatus: *a*, head and succeeding segments; *b*, the ocelli; *c*, five terminal joints of the antennæ; *d*, side view of 3d and 4th scutes; *e*, dorsal view of three segments; *f*, seven terminal segments. Highly magnified.

THE PRIMORDIAL CONDITION OF VERTEBRATES AS SEEN IN THE SKELETON OF THE HOG FISH AND THE LAMPREY.—A striking paper on the morphology of the Marsipobranchs, read by W. K. Parker before the Royal Society, is given in abstract by *Nature*.

In seeking light upon the primordial condition of the Vertebrata, says the author, one naturally looks to such forms as the Myxinoids. For in these types, even in the adult state, there are neither limbs nor vertebræ, and no distinction between head and body, except the beginning in the head, of a cartilaginous skull; a continuous structure—not showing the least sign of secondary segmentation, and by far the greater part of which is in front of the notochord, or axis of the organism. But here our *gradational* work agrees with the *developmental*, for the continuous skull-bars constantly arise before the secondary cartilaginous that are found between the myotomes behind the head. Evidently, therefore, the early "*Craniata*" grew supports to the enlarged and subdivided front end of their neural axis, long before anything beyond strong fibrous septa developed between the muscular segments of the body. As for the linear growth, the greater or less extension backwards of the main organs—circulatory, respiratory, digestive, urogenital—that, in the evolution of the primary form, was a thing to be determined by the "surroundings" of the type. "Thereafter as *they* may be" was the tentative idea in this case.

"Certainly in the Marsipobranchs and in their relations, the larval 'Anura,' we have the most archaic 'Craniata' now existing; in these the organs may be extended far backwards in a vermiform creature, as in these low fishes, or kept well swung beneath the head—the body and tail together forming merely a propelling organ, as is seen in tadpoles, especially the gigantic tadpole of Pseudis.

"Thus we see that in low, limbless types there is no necessity for the development of more than fibrous 'metameres;' but the vesicular brain, the suctorial lips, the branchial pouches, and the special organs of sense—these all call for support from some tissue more dense than a mere fibrous mat or web. In the Myxinoids we find that *four* special modifications of the connective tissue series are developed for the support of the properly *cephalic* organs, and for them only; thus these fishes are *Craniata*, but are not *Vertebrata;* that is, if we stick to the letter, which, of course, we do not.

"At first some disappointment is felt, after careful study of these types, for, notwithstanding the low level in which they remain, they are mere specialized Ammocœtes, keeping on the same 'platform' as the larvel lamprey; yet some parts of their organization do undergo a marvelous amount of transformation, and are, indeed, as much specialized in conformity with their peculiar habits of life *as any Vertebrates whatever, the highest not excepted.*

"Yet, on the whole, the Myxinoides are a sort of Ammocœtine type, whilst the transformed Ammocœte, the larval lamprey, comes nearest to the untransformed frog or toad—the tadpole. But the mere putting of this show (suggests at any rate) what *losses* the fauna of the world has sustained during the evolution of the

Craniate forms; *now*, the Myxinoids, Petromyzoids, and anurous Amphibia, must all be kept within call of each other; but the types that have been culled out between them cannot be numbered. Some other kind of fish are evidently the descendants of primordial Marsipobranchs, notably Lepidosteus."

In the second part on the lamprey, the author thus closes after comparing the lamprey with the tadpole. "These things show how this *temporary* Petromyzoid, the tadpole, blossoms out into unthought of specializations; it becomes a *quasi-reptile*, worthy of a place far above the lamprey, and even far above all other Ichthyopsida."

The Electrical Organs and Distribution of the Torpedinidæ.—Professor Du Bois Reymond, in a late address to the British Association, referred to the researches of Professor Babuchin, of Moscow, on the development of the electrical organs of Torpedo, and stated his conviction that the average number of columns and septa should henceforth be considered an important character in the diagnosis of the species of the family. According to the researches referred to, the electrical organs are formed by the metamorphosis of striated muscle, and as they grow increase in size by the growth of the columns and septa, not by additions to their number.

T. occidentalis Storer, occurs upon the British coasts.

Importations of Indian Pheasants.—M. W. Jamrach, in a communication to the director of the Jardin d'Acclimation, gives some interesting particulars relative to the importations of various pheasants made by him since 1864. The total number of birds forwarded was 2936, of which 1662 arrived safely. The first attempts to bring these birds, via the Cape of Good Hope, resulted in almost total loss, and land transit via Suez proved no better. Since the opening of the Suez canal, by far the greater portion, and, upon some occasions, all the birds forwarded arrived safely.

The greater portion of the birds were *Lophophones refulgens* and *Ceriornis satyra*, but numerous examples of *Euplocomus vieilloti* and other Euplocomi, as well as of *Ceriornis hartingii* and *Argus giganteus*, were also brought over. In consequence of the prohibition of the chase during five years in the countries subject to English rule, it has been exceedingly difficult to procure these birds, and the total expense of their collection and transit, notwithstanding the high prices obtained, reaching five hundred dollars or more for a single Lophophore, is estimated by Mr. Jamrach to exceed the receipts by about $15,000.

A many-named Bird.—The great American bittern has his strange manners and sayings only equaled by the strange epithets which have been conferred upon him. In a still evening we may hear him calling out to his fellows in neighboring sloughs, "Too goód, too goód," in a slow, soliloquizing manner, but with a deep

guttural emphasis on the last syllable, which leads us to fancy he has found some uncommonly fat frog for his supper. If the bittern of the Old World has a similar note, as is not improbable, we discover another reason for believing the "kippod" of Isaiah to be the bittern; a point about which there has been much discussion. We may suppose the name an imitation of such a note. Our bird gives at other times as a burden of his revery, "Co-che-lúnk, co-che-lúnk-ca-chúnk," with variations. These notes are much like a blow upon wood, hence the name "stake driver." Others compare them to the sound of a pump when the piston strikes the water and so give the name "thunder-pumper." Others, seeing a resemblance to the intermittent rush of water, call him "water belcher." From some of his fuller notes, which have a resemblance to the bellowing of a bull, comes the expressive names, "bog bull," "bog bumper," "mire drum" and the Latin name, *botaurus*, whence comes our name bittern. In Chaucer's time the intermediate stage of the word is seen in the line "as a *bitore* bumbleth in the mire." From its common attitude of rest, with its bill pointing straight up, which, with its streaked plumage, makes it very difficult to distinguish from the stems of plants around it, it has gained the names "look-up," and "garde soliel." The name "poke" may refer to the same thing, but more probably to its slow, awkward movements. Other names less significant, are "Indian hen" and "Indian pullet."—*J. E. Todd.*

The Biscayan Whale.—So few are the remains of this animal, once as important to the whalemen as the Greenland whale is now, that the discovery, in the museum at La Rochelle, of a humerus of this species, is worthy of note. The only complete skeletons in Europe are those of the museums of Copenhagen and Naples. This whale is probably identical with *Balæna cisarctica* Cope, of which the Museum of the Academy of Sciences, of Philadelphia, contains a skeleton. New England, therefore, shares with the Biscayans the responsibility of the almost total extermination of the species on their own coasts.

The Reproduction of the Hydrozoa.—M. de Varenne has recently studied the development of the ova and spermatozoa in *Podocoryne cavnea*, *Plumularia echinulata* and some other species, and has conclusively shown that in these forms at least the ova and parent-cells of the spermatozoa are developed exclusively from the endoderm, as stated by Kölliker, Haeckel and Allmann. He has also shown that in the species examined the sexual elements invariably form within the stem, and that the budding of the gonophore follows their formation. As the gonophore buds, the accumulated ova and sperm-cells enter its interior. Schultze, in 1873, and afterwards Allmann had noticed the presence of ovules in the stem of hydroids, and Ed. van Beneden, Goette and Weissman had shown that ovules were formed before the production of sporosacs.

This origin of the sexual products independently of and previous to the formation of the sporosacs, appears at first sight to militate against the theory of the alternation of generations, and to reduce the sporosacs, demi-medusæ and medusæ of the fixed hydrosomes to the rank of reproductive apparatuses. But, to say nothing of the fact that the observations only refer to a few forms, and must be greatly extended before the facts proved can be accepted as general, there remains the other fact that the limits of the meaning of such words as "reproductive apparatus," "organ" and "individual" are not definitively settled. Even a young mammal is in a sense a "reproductive apparatus" specialized for the purpose of carrying on the species, and in the hydroid sporosac we simply have one of the lowest terms of a series that culminates in an independent organism.

M. de Varenne finds that the ova and parent-cells of the spermatozoa come to occupy in the gonophore a position apparently above the endoderm, because their accumulation divides the endoderm into two portions, allowing their escape. Subsequently the break in the endoderm is made good beneath the sexual products, but is always surrounded by a thin lamella secreted by this new formation, and the intermediate lamella found in the stem of the hydroid covers also the ova in the sporosac, although in the latter it is so compressed that it is hard to perceive.

M. de Varenne has traced the complete series of changes by which, in one hydrozoan, the cell becomes an ovule. The first step is the suppression of the flagellum of the endodermic cell, then follow great increase in size, augmentation of the nucleus (which becomes highly refractive) and the assumption of the spherical form.

According to our author, the vitellus of the ovum corresponds to the protoplasm of the cell, the germinal vesicle to its nucleus, and the germinative spot to its nucleolus; the primary mother-cells of the spermatozoa give origin to many secondary mother-cells, which again divide and form a testicular mass of mother-cells endowed with power of spontaneous oscillation.

Huxley, Keferstein, Kleinenberg, Schulze and others have stated that the sexual products of animals proceed from the ectoderm, while others derive the ova from the endoderm and the spermatozoa from the ectoderm, and still others reverse this.

The interesting query is—Does the development of these elements follow the same rule throughout the animal series?

Distribution of Unio pressus (Lea).—Mr. A. F. Gray's notes on this species in Amer. Naturalist (Feb., 1883) recall my own observations on it. Dr. James Lewis found it in the outlet of Owasco lake, a tributary of the Seneca river, but in extensive collecting in that river I have obtained but one specimen. In some small streams flowing into it, however, it is abundant, and sometimes of very large size. I have also observed it sparingly

in the Erie canal at Syracuse, but never in lakes. It seems to prefer small streams with muddy bottoms, and there to form isolated colonies. But one sometimes meets species in unexpected localities. *Margaritana rugosa* Barnes, is a river species, but is abundant in Onondaga lake, and *Unio rosaceus* De Kay, generally restricted to Seneca lake, I have collected in Cayuga lake. *Unio pressus* is still obtained at Norman's Kill, and Coleman T. Robinson collected it near Buffalo, N. Y.—*W. M. Beauchamp.*

THE AMERICAN HORSE.—It is generally understood, and the fact (if it is a fact) has been almost universally accepted, that the horse was unknown in the new world previous to the advent of Spaniards in North and South America. Late discoveries and investigations, extending from Bering's straits to Patagonia, have revealed the fact (see Professor Marsh in Encyclopedia), that in North and South America we have twelve fossil species of the genus Equus, and thirty more species allied to them.

Having had occasion to send to Paris to purchase some rare maps of the fifteenth and sixteenth centuries, I received among them the map of Sebastian Cabot, "Piloto Mayer" of Charles the Fifth, King of Spain. This map, drawn in a circular projection by Cabot himself, on which he has delineated his own and the discoveries of John Cabot, is of singular value as representing the true state of geography and discovery in the early portion of the sixteenth century, and was drawn up prior to the year 1546-47. Sebastian Cabot having left for England, to take service there in 1547, this map was drawn by him while he was in the Spanish service previous to that date.

Now it is an incontestable fact that Cabot went in 1527 to the east coast of South America on an exploring voyage, that he discovered the rivers La Plata and Parana and explored them some distance inland, returning to Spain in 1530.

Upon examining that map I find that the Rio La Plata was explored up to the 25th parallel of north latitude, and Spanish names given to its branches and all prominent points; and in addition he has marked on the map pictures of the natives, prominent animals, and some trees, and that at the head of the La Plata, with the puma and parrot, or perhaps the condor, he has given the horse as apparently a quadruped that existed then on those vast plains of the *Gran Chaco*, where to day they roam in countless herds. It may be claimed that this is not proof of their native origin; but we claim that it is a fair presumption, for neither Spaniards in Peru or other parts of America, nor even Portuguese, had been long enough in South America for the few Spanish horses introduced to have roamed wild from Peru to the head of the Paraguay and Parana rivers, and increased in numbers sufficiently to have attracted the attention of the Spanish explorers. The period was too short, and the distance too great from the Spanish possessions in Peru across the vast forests of the

Andes, for such a rapid increase. We can reconcile this discrepancy only by believing that the paternity of the vast herds of the Argentine Republic and of Paraguay was a native breed of American horses, mixing afterward with the Spanish breed introduced by the conquerors. Not twenty years had passed between the discovery of Peru and the discovery of the Rio La Plata.—*E. L. Berthoud in Kansas City Review.*

ZOOLOGICAL NOTES.—*Protozoans.*—Künstler's article on the flagellate infusoria, in which, like Ehrenberg of old, he discovers a stomach, intestine, uterus, etc., has been severely criticized by Bütschli, who also claims that the author's new form *Künckelia gyrans* is neither more or less than a Cercaria!——The "corpuscles" or psorosperms of the silk worms are by Balbiani termed *Microsporidia*, with affinities to the Sporozoa of Leuckart, which includes the Gregarinida, the oviform Psorosperms, the tubuliform psorosperms, and those of fishes.

Worms.—The Brachipoda, especially Terebratula and Waldheimia, have been carefully studied anatomically and histologically by Van Bemmelen (Jenaischer Zeitschrift, December 27, 1882), who fully confirms Morse's view as to their Vermian affinities. He however insists that the agreement between the Brachiopoda and Chætognaths (Sagitta) is so close that "they must be regarded as branches of one and the same animal stem."——The same Zeitschrift, contains an anatomical and histological research, by J. Steen, on a sea-worm, *Terebrellides strœmii*, with three plates.——The tower-like construction made, as Darwin supposed, by an exotic worm (Perichæta) from Eastern Asia and naturalized near Nice, have been found by Trouessart, who surprised the worms at work, to be a common earth worm, *Lumbricus agricola*. The anterior part of the body was lodged in the tower. After a long period of rain these towers are built probably to protect the galleries from rain, and to afford a breathing place for the worms, where they are not seen by birds. Perhaps similar "towers" made in this country in low, wet localities by crayfish and the pupal *Cicada 17-decim*, are for a nearly similar purpose.——A new species of Branchiobdella from the river crayfish of Leipzig, is described by Dr. C. O. Whitman in the *Zoöl. Anzeiger* for Nov. 27. It appears also from Dr. Whitman's explorations in Japan that *Astacus japonicus*, like the European *Astacus fluviatilis*, has three parasitic species of Branchiobdella.——At a late meeting of the Linnean Society of London Mr. A. P. W. Thomas exhibited a series of specimens illustrative of the life-history of the liver fluke (*Fasciola hepatica*). His experiments show that the embryos of the fluke as free cercariæ burrow into and develop within the body of *Limnæus truncatulus* and thereafter pass with the herbage into the stomach, and ultimately the liver of the sheep. Salt added to the sheep's diet is found to act as a prophylactic.

Several animals, new to science, were described at a recent

meeting of the French Academy. One is a strange fish brought up from a great depth off the Morocco coast; it is about a foot and a half long, and of deep black color; but its most striking feature is its very large and capacious mouth with elastic membranes, much resembling a pelican's. Probably, food is partly digested in this cavity. The fish (which M. Vaillant calls *Eurypharynx pelecanoides*) has very little power of locomotion——M. Brongniart described a new fossil insect of the order of Orthoptera from the coal formation of Commentry (Allier). Insects are rare in the carboniferous strata; hitherto only 110 specimens have been obtained in the whole world. That now found is of remarkable size—about 10 in. long, and the family of Phasmidæ, or "walking-stick insects," is that which comes nearest to it. M. Brongniart names it *Titanophasma fayoli* (M. Fayol sent it). The upper part of the thorax not being preserved, it is impossible to say whether the insect was winged.——M. de Merejkowsky described a new class of infusoria, called Suctociliates, and forming a sort of connecting link between Ciliates, which are characterized by small vibratory hairs, and Acinetians, which have no such hairs, but have *suckers*.

Echinodermata.—Professor Jeffrey Bell, in his notes on the Echinoderm fauna of Ceylon (*Ann. and Mag. Nat. Hist.*) mentions an Antedon of unidentified species. Professor Bell concludes that the tendency to fission under extenal irritation became in the Ophiurids the parent of a habit of fission or simple reproduction, and that, carried on under certain conditions, this led in certain species to the suppression of free-swimming embryos, and the substitution of viviparity. *Ophiomastix annulosa* reaches a spread of 800 mm. or about 32 inches. M. R. Koehler (*Comptes Rendus*) finds the circulatory apparatus of the regular Echinoidea somewhat different from that usually described, and approaching that of the irregular Echinoidea. There are two peri-œsophageal rings, two vessels in each ambulacral zone, and a double sand-canal, affording a communication between the excretory organ and the circulatory system. Thus there is complete independence of the nervous and circulatory systems. M. R. Koehler has experimented at Marseilles upon the hybridization of Echinoidea, and obtained perfectly developed plutei from *Strongylocentrotus lividus* ♀ and *Sphærechinus granularis* and *Psammechinus puletrellus* ♂. The same species, crossed with *Spatangus purpureus*, reached the blastula and even the gastrula stage. Psammechinus, a regular Echinid, formed perfect plutei when crossed with female Spatangus. A reversal of the sexes of these two species gave but slight results.——D. C. Danielssen and J. Koren discuss the genera Crossaster and Lophaster (*Ann. and Mag. Nat. Hist.*), and conclude that both should be suppressed and the species included in Solaster.

Mollusca.—M. Bouchon Braudely (*Comptes Rendus de l'Academie des Science*) states that the Portuguese oyster (*Ostrea*

angulata) which has been introduced into the Gironde by discharge from a damaged Portuguese vessel, is certainly unisexual, as he has opened numbers at all stages of the reproductive period, and found only the elements of one sex in all. *O. edulis* is admitted on all hands to be hermaphrodite, but as the genital gland rarely presents the two sexes equally matured, it is probably not self-fertilizing. Artificial fecundation has been practiced with success by this naturalist with the Portuguese oyster in the waters of the Gironde.——A colossal cuttle-fish, named *Architeuthis verrillii*, was found stranded at Island bay, Cook's straits, New Zealand; the longer arms measured 25 feet. Another large cuttle with a body nine feet two inches in length belongs to a new genus, called by Mr. Kirk, Steenstrupia.

Cephalopoda.—Among works recently published that cannot fail to be of interest to American naturalists, are a "Monograph of the British Fossil Cephalopoda, by J. F. Blake, M. A., and a Catalogue of the Fossil Foraminifera (British and foreign) in the British Museum, by Prof. T. Rupert Jones. Only the first part of the former work is yet issued, and treats of the Silurian species. One hundred and forty-three species are recorded, about seventy of which are straight or curved Orthoceratites.

Gastropoda.—Mr. E. A. Smith (*Ann. and Mag. Nat. Hist.*) adds more than sixty names to the genus Pleurotoma, which he states now contains nearly *thirteen hundred* recent species! and adds "many of these have proved identical with others, and a good many more will no doubt, on further investigation, fall into the same category of bad species." Few will doubt this conclusion.——D. J. Gwyn Jeffreys gives (*Ann. and Mag. Nat. Hist*) a list of seven species of shells dredged in the Black sea—none of these, except *Mytilus edulis*, had been previously enumerated, and one, *Trophon breviatus* is new. The Italian surveying ship *Washington*, which made an exploration around Sardinia and the western coast of Sicily in 1881, procured some mollusca and brachiopods at considerable depths. *Terebratula vitrea* was taken at 841 fathoms, two species of Nucula at about 1500 fathoms, *Dentalium agile* at various depths from 86 to 1963 fathoms, *Defrancia tenella* at 1963 fathoms, and *Scaphander librarius* at about 1500 fathoms.

Crustacea.—In the *Archives du Musèe Teyler* (Haarlem, Holland) T. C. Winkler compares the recent crustacean genus, Aræosternus, lately described by Dr. J. G. De Man, of Leyden, and considered to mark a new sub-family of the Astacidæ, equal to the Palinuridæ or the Seyllaridæ, with the fossil genera Pemphix and Glyphea. The result of this comparison is that *Aræosternus wieneeki* De Man, the only known example of which was brought from a small island near Sumatra, is the representative of a long line of extinct genera, extending backwards in an uninter-

rupted series to the lower Lias, and that the ancestor of the liassic Glypheas may be recognized in the triassic species described under the name of *Pemphix sucuri*.——*In the Annals and Magazine of Natural History*, C. Spence Bate describes *Eryonicus cæcus*, a blind transparent abyssal crustacean allied to Willemœsia, and dredged by the *Challenger* in 1675 fms. off the Canaries. The first pair of pereiopoda are long, with a narrow slender chela, the dorsal surface is elevated, and the pleon folded against the ventral surface of the pereion. It has a well-developed fan-tail, and in life the alimentary canal is bright red and the hepatic lobes yellow.——Mr. E. J. Miers writes on the genus Ocypoda. He admits ten well-established species. *The Annals and Magazine of Natural History*, contains a valuable article upon the Entoniscidæ, by Dr. R. Kossman. This writer asserts that, notwithstanding the statements of Fraisse and Giard, all the Entoniscidæ have separate sexes, and the females carry their ova in paired brood-leaves like the rest of the Isopoda. The males are excessively small, and have no rudiments of maxillæ and maxillipeds. The females reside in a sac upon the crustacean they infest, and it is only after a separation of this sac that their structure can be made out.——The *Quarterly Journal of Microscopical Science* for January, publishes, with a plate, a posthumous paper by the late Von Willemoes Suhm on a crustacean larva, at one time supposed to be the larva of *Limulus mollucanus* (See NATURALIST, vol xvi. p. 292.) It is sufficiently evident from the drawing and description that this is more probably, as the author finally believed, a Cirripede larva. The colors of *Idotæa tricuspidata* are described and figured by C. Matzdorff in the Jenaische Zeitschrift für Wissenschaft. The coloring is believed to be due to a sympathetic change in color; this coloring is dependent upon the habitat, and varies in accordance with the differences in the latter.——A number of blind subterranean Isopod and Amphipod Crustacea have been obtained from a well in New Zealand; the Isopod is remarkable for having only six pairs of appendages to the seven thoracic segments, seven being the normal number.

Vertebrates.—G. A. Boulenger describes *Pternohyla fodiens*, a tree-frog having large metatarsal tubercles that enable it to bury itself in moss, after the manner of a Pelobates. Its toe-disks are small, so that it cannot climb a glass. Habitat Mexico.—(*Ann. and Mag. Nat. Hist.*)——A number of communications respecting the sea-serpents have appeared in *Nature*, and also in *Forest and Stream*, and we have heard privately of other cases. So numerous are they becoming that we wonder that the bones of so common an animal do not turn up on the sea-shore either of the New or Old World. Until these be forthcoming we shall be a skeptic as to the existence of this shadowy organism.——A new genus of Cœcilians or blind snakes has been discovered near Lake Tanganyika, East Africa, and described by G. A. Boulenger, under

the name *Scolecomorphus kirkii.*——In the same number of the *Annals and Magazine of Natural History*, Boulanger gives his reasons for regarding *Rana circulosa* of Rice and Davis in Jordan's Manual of Vertebrates as a synonym of Baird's *Rana septentrionalis.*——We have received through B. Westermann & Co., New York, the seventeen chromo-plates of Volume I., "Birds of Brehm's Thierleben. They surpass anything of the sort which we have ever seen. The artist is Olof Winkler. The price, five marks for seventeen plates, is reasonable enough.——The hovering of birds is discussed by several contributors to *Nature* of February 1 and 8. The general opinion seems to be that the bird while hovering is supported by an upward current of air; one writer, however, maintains "that, given a steady wind blowing with a velocity which lies somewhere between certain possible calculable limits, a hawk can remain for a time apparently motionless above a point; he is, in reality, descending a slightly inclined plane, and requires to recover vertically lost ground by the occasional use of his wings."——A new bird of paradise collected on the D'Entrecasteaux island, south-east of New Guinea is described in the *Ibis* as *Paradisea decora.*——To the same society Dr. F. Day showed examples of trout, viz., of the American "Brook trout," reared in an aquarium; another reared at Howietoun, near Stirling, and a hybrid between the American and common English trout, all in illustration of his paper on variations in form and hybridism in *Salmo fontinalis.*——The bower birds, regarded by Elliott and Salvadori as connected with the birds of Paradise, have recently been studied by Mr. Sharpe, who, changing his former opinion, now agrees with Mr. Elliott as to the position of these curious birds.——It appears that the tuatara lizard (*Sphenodon punctatus*) of New Zealand entertains as a commensal three species of petrels which live in holes dug out by the lizards, and keep apparently on the best terms with them. According to Mr. Reischek this rare and interesting lizard which lives on the "Chickens," a group of islands on the east coast of North island of New Zealand, "excavates its hole mostly on the western slope of the islands. The entrance to its chamber is generally four or five inches in diameter, and the passage leading to it often two or three feet long, first descending and then ascending again. The chamber itself is about one foot and a half long, by one foot wide and six inches high, and is lined with grass and leaves. The petrels and tuataras have their nests separately, one on each side at the entrance, so that they in no way interfere with one another." The tuatara feeds by night on worms, beetles, crustaceans and offal, brought in by the petrels. Mr. Reischek believes that the tuatara lays in February, as he took eight fully developed eggs from one in January.——Mr. Sclater's monograph of the jacamars and puff-birds is said by *Nature* to be uniform in size and style with Mr. Sharpe's "Kingfishers," Messrs. Marshall's "Barbets"

and Capt. Shepley's "Sun-birds," forming one of the series of illustrated ornithological monographs prepared by different members of the British Ornithologists' Union. A companion volume, by Mr. Dresser, on the "Bee-eaters," is in a forward state, and similar works are already projected.——Another subarctic mammal, *Spermophilus rufescens*, which lives in the Orenburg steppes of Asia, has been found fossil in the loess and caves of Germany, as reported by Blasius in the *Zoöl. Anzeiger*.——C. J. Maynard states that the ivory-billed woodpecker (*Campephilus principalis*) which in Audobon's time inhabited the Atlantic coast as far north as Maryland, was common in the lower parts of the Carolinas, in Georgia, Alabama, Louisiana and Mississippi, and occurred as far north as the mouth of the Ohio, and westward of the Missouri throughout the forests along the rivers to the base of the Rocky mountains; is now, unless it lingers in the heavily wooded parts of the state of Mississippi, confined to a small belt of "hummock" or "cypress" timber land, about a hundred miles long by fifty in width, in the northern part of Florida, and is rare even there.

PHYSIOLOGY.[1]

THE ELECTROMOTIVE PROPERTIES OF THE LEAF OF DIONÆA.—Professor G. B. Sanderson (Trans. Roy. Soc., Part 1, 1882), gives an account of his researches on the electrical relations of the different parts of the leaf of Dionæa in its resting and in its excited condition, together with a résumé of similar work of other investigators.

The leaf of Dionæa contains two or three layers of parenchymatous cells whose protoplasm has great attraction for water. The leaf owes its expanded condition while at rest to the turgidity of the parenchyma cells whose protoplasm contains much imbibed water. But when the leaf is excited, as by a touch, the protoplasm of the upper layers of parenchyma cells in the laminæ and midrib squeezes out water, and the leaf closes up, owing to the strain exerted by the still swollen under layer of cells.

With the aid of the galvanometer, Professor Sanderson finds that different points upon the surface of the leaf are usually, but probably accidentally, in different electrical conditions; but after one or more excitations, the under surface of the leaf becomes always more positive than before. But if the galvanometric observation be made while the leaf is stimulated mechanically or electrically, the under surface of the leaf, as compared with the upper, becomes to a marked degree more negative than before. This negative change begins about one-twentieth of a second after the application of the stimulus, and ceases at about the middle of the first second; that is, in that time the under surface of the leaf has returned to its former electrical condition. In the succeeding

[1] This department is edited by Professor HENRY SEWALL, of Ann Arbor, Michigan.

second the electrical relations of the two surfaces of the leaf are reversed, the lower surface becoming now positive to the upper.

"A voltaic current directed from the upper to the under surface, which is too weak to invoke an excitatory response, produces an increase of the positivity of the under surface, limited to the part of the lobe through which the current passes, which lasts several seconds after the current is broken. * * * When a leaf is subjected to series of inadequate induction shocks at short intervals (*e. g.*, one-twentieth of a second), the response may occur after a greater or less number of excitations, according to the temperature at which the experiment is made and the strength of the current. * * * In a series of mechanical excitations, each of which is just adequate to produce an electrical response, those which occur earliest are followed by no change of form. Of the later members of the series each produces a measureable movement, the extent of which becomes greater each time that the excitation is repeated until eventually the leaf closes."

The first electrical change which the leaf of Dionæa undergoes after excitation (the increased negativity of the under surface of the leaf) is probably a physiological change which is the outcome of some functional explosion in the cell protoplasm, and is closely analogous to the "action current" which is a sign of functional excitement in an animal nerve or muscle. The second electrical condition, which is more slowly brought about and is more lasting, that in which the under surface of the leaf becomes positive to the upper, is probably due simply to the transference of water from the cells to the intercellular spaces.

The Influences which determine Sex in the Embryo.—Professor E. Pflüger publishes at length an account of experiments, performed with the greatest care, with the object of throwing light upon some of the most prominent of the obscure problems of the physiology of generation (Pflüger's Archiv., Bd. xxix, Heft 1 and 2). Professor Pflüger made use of frogs in his experiments; many hundreds of the creatures were obtained from various neighborhoods, and were maintained while under observation under conditions made as nearly normal as possible.

The first question attacked is: Does the concentration of the spermatic fluid of the male influence the sex of the offspring? Much care is necessary in handling frogs' eggs, for they are exceedingly susceptible of mechanical injury. The pair of frogs are parted during the sexual embrace, and therefore at a time when the products of the generative organs are presumably ripe, the animals are killed and the spermatic sacs of the males are emptied into a watch crystal. A second watch crystal filled with water is impregnated with spermatazoa by dipping into it the tips of the fine pair of scissors which has just been used to cut open the spermatic sacs and has, therefore, some of their contents clinging to it. The dilute spermatic fluid of the second watch

crystal was often further diluted from ten to twenty volumes and from these new mixtures fresh quantities of water in watch crystals were impregnated by the transference of a film of fluid clinging to the scissors' tips. Into these watch crystals filled with the fluid of a single male in different states of concentration, there were allowed to glide some of the eggs of the female taken from the right uterus. The outcome of the experiments established two facts: First, the fertilizing power of the spermatic fluid was not diminished by dilution, all the ova were fertilized in each observation; second, dilution of the male fluid had no effect on the sex of the frogs which came to maturity after the artificial fertilization.

In young frogs there are three varieties of sexual character, male, female and hermaphrodite. The hermaphrodites become finally either male or female, but in their earlier stages they have the sexual organs of the female only; in those which are finally to become males, the testicles gradually develop round the ovaries and the latter are resorbed. This apparent numerical predominance of the female in early stages of the fuller formed frog has led some investigators astray.

The author finds that no batrachian egg segments without previous fertilization.

The fertilizing power of the male fluid diminishes greatly and progressively after the season for sexual union.

It is impossible to produce offspring by the union of the male and female products of two different batrachian species, though segmentation of the egg, frequently of abnormal type, may be started by this artificial union.

The production of Disease by Bacterial Organisms.—One of the most remarkable chapters in the history of biological science, when it is written, must be that which treats of the development of our knowledge in the interval included between the early days of Liebig and the present time, concerning the nature of the organized ferments. The rich rewards of discovery which invited the investigator toward the unstudied hosts of bacteria life, and the apparent ease with which definite results were experimentally obtained, has tempted scores of observers, some, perhaps, little qualified for the task undertaken, to enter upon the investigation of a subject which has proved itself one of the most difficult and complex in the whole range of biology. We find, consequently, even in a single aspect of bacteria life, its relation to infectious diseases, the most contradictory opinions.

Ever and anon is announced a brilliant discovery concerning the causal relation of bacteria to some malignant disease, apparently opening a way to the rational treatment or extermination of the distemper; but after a time counter experiments performed after other methods throw doubt upon or disprove the conclu-

sions before considered so logical, until the inexpert looker-on is inclined to despair of ever seeing certainty finally arrived at.

Some investigators in our own country, well fitted by talent and education to enter this field of research, have arrayed themselves in the opposition against views concerning the action of bacteria in certain diseases, which have found among other workers general acceptance.

The *Bacillus tuberculosis* of Koch has gained a world-wide reputation. But Dr. Formad (*Phil. Med. Times*, Nov., 1883), has come to the conclusion that the Bacillus is not the cause of the disease, but is found in abundance in tubercular tissue simply because it finds there its most agreeable food. Formad regards tuberculosis as primarily due to an anatomical defect, namely, a superabundant development of connective tissue and a consequent narrowing of the lymph spaces of the tissue, thus making the latter much more subject to pathological change than is normally the case. The artificial production of tuberculosis brought about by Koch through the injection into living animals of matter infected with Bacilli, Formad does not regard as of great weight, for it was found during the researches on diphtheria, carried out by Drs. Wood and Formad, that the placing of an innocuous object, as a piece of glass, under the skin of a rabbit produced death of the animal by tuberculosis.

It has been generally suspected or believed that a minute organism occurring in the pus obtained from patients suffering from gonorrhœa, is the cause of that disease; but the careful and competent observations of Dr. Sternberg make that hypothesis very questionable (*Med. News*, Jan. 20, 1883). The author writes:

"The micrococcus which I have found in a certain number of pus cells in every specimen of gonorrhœal pus examined by me, is an accidental parasite which has nothing to do with the special virulence of this fluid * * * and a careful search with a first-class objective and by use of staining reagents, has not revealed the presence in this fluid of any other micro-organism than this micrococcus."

The author found that the lower animals could not be innoculated with the disease by the injection of pus into them. By means of artificial cultivation in culture fluids, Sternberg was enabled to produce successive generations of the micrococcus in question, and found that the parasite thus isolated did not produce gonorrhæa when the fluid containing it was injected into the urethra of human patients. Sternberg is led to conclusions supported by Cohn, Koch and others: "My researches show that differences, morphological and physiological, exist among these lowly plants, which make it possible to establish species having characters quite as well defined as have many plants much higher in the scale."

Dr. Schmidt is heretical upon the whole subject of the occur-

rence of bacteria in certain pathological tissues (*Chicago Med. Il.*, Dec.. 1882). Schmidt believes that the forms described as *Bacillus tuberculosis* are nothing more than slender colored crystals of fat which have been produced by the reagents which it is necessary to use in preparing the tissue sections for examination. It is very doubtful, however, whether this view will ever receive worthy confirmation.

THE ORIGIN AND DESTINY OF FAT CELLS.—Some light is thrown upon the problem of the origin and destiny of fat-cells by the observations of Mr. S. H. Gage upon those of Necturus. In the subcutaneous connective tissue of this creature the microscope revealed the presence of fat-cells in all stages of growth; large branched cells with one or more fat drops; cells containing one or two small fat drops and a large one; and some large unbranched cells entirely gorged with fat. The pigment cells were sometimes partly gorged with fat, and some small round or oval cells also contained fat.

Thus it would appear that, as maintained by Virchow, Frey, Klein and others, fixed or branched connective tissue corpuscles may become modified into fat-cells, and also, as asserted by Czajewicz, Rollett and others, migratory corpuscles may become quiescent and turn into reservoirs of fat. After a Necturus has been kept upon sparse diet for some time, the adipose tissue shows but few gorged cells, many trasitional forms, and a greater proportion of branched cells without fat, thus proving that the fat-cell is simply a store of food, and that, when their store is used, the cells revert to their primitive condition of branched or unbranched cells.

RECENT EMBRYOLOGICAL PAPERS ON VERTEBRATES.—The development of the middle germ-layer of vertebrates is being discussed by O. Hertwig in the *Jenaischer Zeitschrift*, with numerous plates containing views of this layer in the different classes. In the same journal J. Walther describes the development of the covering-bones of the skull of the pike (*Esox lucius*). In his paper on the early development of *Lacerta muralis*, W. F. R. Weldon treats chiefly of the mode of formation of the germinal layers, and the early development of the kidney.

EMBRYOLOGY OF THE SILK-WORM.—This has been studied by S. Salvatico, who finds that the amnion appears as a membrane with large nucleated cells like those of the serous membrane, but without pigment. The malphigian vessels originate in the ectoderm. He did not note the early appearance of the rudiments of the genital glands, which was observed by Balbiani in *Tinea crinella*.

DEVELOPMENT OF BITHYNIA, A FRESH-WATER PULMONATE.—After discussing the origin of the larval and adult organs, P. B. Sarasin (Arbeiten Zool. Zoot. Institut zu Warzburg, VI, 1882)

claims that all the organs are formed either directly or indirectly from it; the mesodermal elements do not arise at any definite and single point, and there is no evidence of any cleavage in it, and still less of the formation of a true cœlom. As the endoderm, so-called, does not give rise to the enteron, its homology with the similarly named layer in the chick is to be doubted.

Early Development of the Salpæ.—F. Todaro in his second preliminary paper, published in the Italian Biological Archives, states that he has observed the entrance of a single zoösperm into the egg, its conversion into a male pronucleus, and its fusion with the female pronucleus to form the segmentation-nucleus, while the yolk is derived from the epithelial cells of the ovarian sac. The origin of the embryos of the solitary and compound Salpæ is also described.—*Journal Royal Microscopical Society, Feb., 1883.*

PSYCHOLOGY.

Animal Doctors.—In a recent communication to the Biological Society, M. G. Delaunay observed that medicine, as practiced by animals, is thoroughly empirical; but the same may be said of that practiced by inferior human races, or, in other words, by the majority of the human species. Animals instinctively choose such food as is best suited to them. A large number of animals wash themselves and bathe, as elephants, stags, birds and ants. M. Delaunay lays down as a general rule that there is not any species of animal which voluntarily runs the risk of inhaling emanations arising from their own excrement. Some animals defecate far from their habitations; others bury their excrement; others carry to a distance the excrement of their young. In this respect they show more foresight than man, who retains for years excrement in stationary cesspools, thus originating epidemics. If we turn our attention to the question of reproduction, we shall see that all mammals suckle their young, keep them clean, wean them at the proper time and educate them; but these maternal instincts are frequently rudimentary in women of civilized nations. In fact, man may take a lesson in hygiene from the lower animals. Animals get rid of their parasites by using dust, mud, clay, &c. Those suffering from fever restrict their diet, keep quiet, seek darkness and airy places, drink water and sometimes even plunge into it. When a dog has lost its appetite it eats that species of grass known as dog's grass (*chiendent*), which acts as an emetic and purgative. Cats also eat grass. Sheep and cows, when ill, seek out certain herbs. When dogs are constipated they eat fatty substances, such as oil and butter, with avidity, until they are purged. The same thing is observed in horses. An animal suffering from chronic rheumatism always keeps as far as possible in the sun. The warrior ants have regularly organized ambulances. Latreille cut the antennæ of an ant, and other ants came and covered the

wounded part with a transparent fluid secreted from their mouths. If a chimpanzee be wounded, it stops the bleeding by placing its hand on the wound, or dressing it with leaves and grass. When an animal has a wounded leg or arm hanging on, it completes the amputation by means of its teeth. A dog on being stung in the muzzle by a viper was observed to plunge its head repeatedly for several days into running water. This animal eventually recovered. A sporting dog was run over by a carriage. During three weeks in winter it remained lying in a brook where its food was taken to it; the animal recovered. A terrier dog hurt its right eye; it remained lying under a counter, avoiding light and heat, although habitually it kept close to the fire. It adopted a general treatment, rest and abstinence from food. The local treatment consisted in licking the upper surface of the paw, which it applied to the wounded eye, again licking the paw when it became dry. Cats also, when hurt, treat themselves by this simple method of continuous irrigation. M. Delaunay cites the case of a cat which remained for some time lying on the bank of a river; also that of another cat which had the singular fortitude to remain for forty-eight hours under a jet of cold water. Animals suffering from traumatic fever treat themselves by the continued application of cold, which M. Delaunay considers to be more certain than any of the other methods. In view of these interesting facts, we are, he thinks, forced to admit that hygiene and therapeutics, as practiced by animals, may, in the interests of psychology, be studied with advantage. He could, thinks the *British Medical Journal*, go even further, and say that verterinary medicine, and perhaps human medicine, could gather from them some useful indications, precisely because they are prompted by instinct, which are efficacious in the preservation or the restoration of health.

Suicide of Scorpions—The following experiments made on two species of South African scorpions, by C. L. Morgan, indicate that they do not have any suicidal instinct. He detected no signs of fresh wounds made by the sting. The nature of the experiments were as follows .

1. Condensing a sun-beam on various parts of the scorpion's body. The creatures always struck with the sting round, across and over the heated spot, and seemed to try and remove the source of irritation.

2. Heating in a glass bottle. As this admits of most careful watching, I have killed some twenty or thirty individuals in this way. The creatures very commonly pass the sting over the body, as if to remove some irritant. The poison exudes from the point of the sting and then coagulates.

3. Surrounding with fire or red hot embers, I first took a newspaper, moistened a ring about a foot in diameter with alcohol, and placed a scorpion within the ring. The paper was, by this time ignited. He walked without hesitation through the fire and

tried to make his escape. I made a ring of red hot wood embers and placed a scorpion in the middle. He pushed his way out, displacing two of the embers. I made a better fire-wall, and put him in the middle again. He crept over the embers. I placed him in the midst of a ring of embers on the flat and much-heated stone of the fire-place. He crept over the embers again, but this time got baked before he could escape.

4. Placing in burning alcohol. I placed a layer of an eighth of an inch of alcohol in a shallow vessel, lit the alcohol, and placed the scorpion in the midst of the burning spirit.

5. Placing in concentrated sulphuric acid. I moistened the bottom of a large beaker with a very thin layer of concentrated sulphuric acid, and put in a scorpion. The creature died in about ten minutes. (I have also tried other strong acids, a concentrated solution of sodium hydrate, and a potassium cyanide solution.)

6. Burning phosphorus on the creature's body. I placed a small pellet of phosphorus near the root of the scorpion's tail, and lit the phosphorus with a touch of a heated wire. The creature tried to remove the phosphorus with its sting, carrying away some of the burning material.

7. Drowning in water, alcohol and ether.

8. Placing in a bottle with a piece of cotton-wool, moistened with benzine.

9. Exposing to sudden light. I have not tried special experiments as to this point, but have, on turning over an ant-ball, suddenly exposed a scorpion, hitherto in complete or almost complete darkness, to the full glare of South African sunshine.

10. Treating with a series of electric shocks.

11. General and exasperating courses of worry.

I think it will be admitted that some of these experiments were sufficiently barbarous (the sixth is positively sickening) to induce any scorpion who had the slightest suicidal tendency to find relief in self-destruction.

I have in all cases repeated the experiments on several individuals. I have in nearly all cases examined the dead scorpion with a lens. My belief is that the efforts made by the scorpion to remove the source of irritation are put down by those who are not accustomed to accurate observation as efforts at self-destruction. On one occasion I called in one of my servants to watch the death of a scorpion by gradually heating it in a glass bottle. The creature at once began moving its sting across and over its back, upon which my servant exclaimed, "See it is stinging itself!" I do not wish to imply that all the cases of alleged scorpion suicide are merely instances of careless observation. All I wish to do in this note is to record my individual experience, and to state clearly that after making a series of observations as carefully as I could on a large number of

individuals, I cannot place on record a single instance of clear and unmistaken scorpion suicide.—*Nature.*

Exhibition of Reasoning Power in the Polar Bear.—A contributor to *Nature* relates the following instance of remarkable intelligence on the part of this animal in cracking cocoanuts. In the Clifton Zoölogical Gardens there are two female Polar bears, between two and a-half and three years old, which came here quite young. A cocoanut was thrown into the tank, it sunk a long way, and the bear waited quietly till after some time it rose a little out of her reach. She then made a current in the water with her paw, and thus brought it within reach. This habit has already been several times noticed in Polar bears. She then took it on shore and tried to break it by leaning her weight on it with one paw. Failing in this, she took the nut between her fore-paws, raised herself on her hind legs to her full height, and threw the nut forwards against the bars of the den, three or four feet off. She then leaned her weight on it, hoping she had cracked it, but failed again. She then repeated the process, this time successfully. The keeper told the writer (J. G. Grenfell) she employed the same method to break the leg-bone of a horse. That this is the result of individual experience, and not of instinct, is clear from the fact that her companion has not learned the trick of opening them thus, nor could this one do it when she first came. The method of throwing is precisely similar to that adopted by the Cebus monkey described by Mr. Romanes (Animal Intelligence).

The Senses of Bees.—Sir John Lubbock recently read to the members of the Linnean Society an account of his further observations on the habits of insects made during the past year. The two queen ants which have lived with him since 1874, and which are now, therefore, no less than eight years old, are still alive and laid eggs last summer as usual. His oldest workers are seven years old. Dr. Müller, in a recent review, had courteously criticized his experiments on the color-sense of bees; but Sir John Lubbock pointed out that he had anticipated the objections suggested by Dr. Müller, and had guarded against the supposed source of error. The difference was, moreover, not one of principle, nor does Dr. Müller question the main conclusions arrived at or doubt the preference of bees for blue, which, indeed, is strongly indicated by his own observations on flowers. Sir John also recorded some further experiments with reference to the power of hearing. Some bees were trained to come to honey which was placed on a musical box on the lawn close to the window. The musical box was kept going for several hours a day for a fortnight. It was then brought into the house and placed out of sight, but at the open window, and only about seven yards from where it had been before. The bees, however, did not find the honey, though when it was once shown them they came to it

readily enough. Other experiments with a microphone were without results. Everyone knows that bees when swarming are popularly, and have been ever since the time of Aristotle, supposed to be influenced by clanging-kettles, &c. Experienced apiarists are now disposed to doubt whether the noise has really any effect; but Sir John suggests that even if it has, with reference to which he expressed no opinion, it is possible that what the bees hear are not the loud, low sounds, but the higher overtones at the verge of or beyond our range of hearing. As regards the industry of wasps, he timed a bee and a wasp, for each of which he provided a store of honey, and he found that the wasp began earlier in the morning (at four A. M.), and worked on later in the day. He did not, however, quote this as proving greater industry on the part of the wasp, as it might be that they are less sensitive to cold. Moreover, though the bee's probocis is admirably adapted to extract honey from tubular flowers, when the honey is exposed, as in this case, the wasp appears able to swallow it more rapidly. This particular wasp began work at four in the morning, and went on without any rest or intermission till a quarter to eight in the evening, during which time she paid Sir John 116 visits.

THE FRONTIERS OF INSANITY.—In a lecture before the Ecole de Medicine[1] of Paris. M. Ball describes the tendencies to insanity and abnormal mental action observed in many persons, and classifies them. He concludes an interesting discussion by asserting as Maudesley has done before him, that the world owes nearly all its important innovations to persons whose minds occupy this frontier position. He includes in this class original thinkers, reformers, discoverers and inventors. He confirms the truth of the language of Pope:

> "Great wit to madness sure is near allied,
> And thin partitions do their realms divide."

ANTHROPOLOGY.[2]

RESEARCHES OF MIKLUKHO-MACLAY.—Three or four years ago we used to read almost every month, something wonderful about the researches of Maclay in New Guinea. The gentleman has turned up again, and has been giving to the Russian Geographical Society the benefit of his experience (*Nature*, Dec. 7 and 21, 1882). Of his wanderings we shall say nothing, but simply record his contributions to knowledge respecting anthropology. The natives of the north-west coast of New Guinea, near Astrolabe bay, are in the lowest stage of culture, being ignorant of the use of metals and employing only implements of stone, bone and wood. They did not even know how to make a fire. Their grandfathers told them of a time when they had no fire, they ate

[1] Published in the *Revue Scientifique*.
[2] Edited by Professor OTIS T. MASON, 1305 Q street, N. W., Washington, D. C.

their food raw, and a disease of the gums spread among them. The dead are put in a sitting position, the corpse is covered with leaves of the cocoa-palm, and the women must keep a fire close by until the body is dried. The corpse is buried only if there is nobody to keep fire. Kidnapping of these nations is practiced by the crews of ships of all nationalities of the civilized world. Previous anthropologists had admitted two different races in New Guinea, and had made a distinction betwen the Papuans of the coast and of the interior. The Papuans of the interior, however, belong to the same race as those of the coast, and there is throughout New Guinea but one Papuan race. Virchow makes the Papuans dolichocephalic and the Negritos of the Philippines brachycephalic. Hundreds of measurements by Mr. Maclay show that the purest Papuans range from .62 to .86 in cephalic index. The Papuans do not have the clustered hair attributed to them, and the size of the curl varies even on different parts of the same head. The Malays on the opposite islands have for centuries trafficked with these natives for slaves, turtles, trepang and pearl shells. They even bring Malay girls and exchange them for Papuan girls. The blood, therefore, is very much mixed. The height of the men on the Malay coast varies from 1.74 to 1.42^{mm}, of the full-grown women it is about 1.32.

At Port Maresby, on the southern coast, Mr. Maclay found a mixture of Polynesian blood among the Papuans. These Metis have a lighter skin and uncurled hair, the women tattoo themselves as long as they have children, thereby improving their beauty.

Measurements were made upon the heads of Negritos near Manila, whose cephalic index was .875 to .90. One woman was only 1.30 meters in height. Their faces were like those of the Papuans, while their customs are akin to those of the Melanesian islands. They reverence the fire and are very hospitable. Orang-utan, or wild tribes of the Malay peninsula, were visited and described. The sumpitan, or blowing tube, with its tiny poisoned arrows is their deadly weapon. In the mountains at the sources of the Pakkan river, the traveler found Orang-Sakays, or pure Melanesians. They are like the Negritos of Luzon. The men are in height 1.46–1.62^{m}, the women 1.35–1.48^{m}. The skulls are .74–.82 for men, .75–.84 for women, and .74–.81^{m} for children. The diameter of the curls of hair is 2–4^{mm}. The color of the skin is 28–42, and 21–46 Broca. One hardly knows which to admire more, the intrepidity and grip of Mr. Maclay, or his painstaking enthusiasm in his work.

Revue d'Ethnographie.—This new candidate for favor has now passed through its first year, under the management of Dr. Hamy, conservateur of the Ethnographic Museum at Paris. While ethnography, technology and sociology have not been neg-

lected in the *Revue d'Ethnologie*, they have been quite overshadowed by anatomical and archæological papers. Indeed, this fact was the first cause of the foundation of the *Revue d'Ethnographie*. The papers that have appeared in the review have been so important, as a general thing, that the list is appended:

Cessac, L. de—Fétiches de pierre, &c., de l'île de S. Nicolas (Cal.), p. 30.
Cessac, L. de—Sur les Comanches, p. 94.
Croix, I. E. de la—Les Sakaies de Perak, Malacca, p. 317.
Duhousset, E—Les initiateurs de l'art oriental, p. 288.
Duhousset, E.—Les arts décoratifs au Petit-Tibet et au Cachemire, p. 381.
Fegueux, E.—Les ruines de la Juemada, p. 119.
Hamy, E. T.—Figures et inscriptions à El Hadj Memóum, p. 129.
Hamy, E. T.—La Croix de Teotilhuacan, p. 410.
Landrin, A.—Ecriture figurative et comptabilité en Bretagne, p. 369.
Lenormant, Fr.—Les Truddhi et les Specchie d'Otrante, p. 22.
Lenormant, Fr.—L'ethnographie ancienne du Mediterraneén, p. 226.
Martin, Ern.—Les funerailles d'une impératrice de Chine, p. 230.
Montano, J.—Indigenes de la province de Malacca, p. 41.
Moura, J.—Le Cambodge préhistorique, p. 505.
Peney, A.—L'ethnographie du Soudan Egyptien, I. Le Sennar; Les Turcs au Soudan. II. Le Kourdofan, p. 397, p. 484.
Quatrefages, A. de—Distribution géographique des Négritos, p. 177.
Retzius, A.—Ethnographie finnoise, p. 81.
Révoil, G.—Archéologie et ethnographie do Comal, pp. 5 and 235.
Rochebrune, A. T. de—Mollusques chez les peuples anciens et modernes, p. 466.
Scheube, Dr.—Culte et fête de l'ours chez les Ainos, p. 302.
Schumacher, P.—L'age de pierre chez les Indiens Klamaths, p. 500.
Verneau, R.—Inscriptions lapidaires de l'archipel Canarien, p. 273.

As in most journals of the kind, the correspondence, reviews and analyses, notices of societies, expositions, collections and museums are quite as valuable as the original papers.

LEGENDS OF THE IROQUOIS.—It is quite curious how a book will travel round without being noticed. Mr. Elias Johnson, a native Tuscarora chief, published two years ago, at Lockport, N. York, a book entitled "Legends, Traditions and Laws of the Iroquois or Six Nations, and History of the Tuscarora Indians." It has just come within the circle of the NATURALIST'S vision. The first portion of the volume is a curious justification of the Indian character by a recitation of parallel crimes and atrocities among the whites. Here and there the author holds aside the door of the wigwam and gives us just the faintest glimpse of true Indian life. For instance, has any one before hinted that scaffold burial arose from the fact that resuscitation frequently takes place after people are supposed to be dead? In many of the villages was a house for strangers, and their hospitality was unbounded. Some light is thrown upon savage mythology by the recital of several myths, as The origin of the continent and of the animals, Flying head, Stonish giants, Atotarho, &c. The subjects of edu-

cation, treaties, civilization are treated in an off-hand manner. The sociologists have racked their brains to find out how lower races got from mother-right to father-right. Now there is no doubt that the progress was gradual, consisting of several stages. Mr. Johnson gives us one of the steps and a very important one, illustrating also the saying: "Where there is a will, there's a way to break it." Let us suppose that a bear man marries a deer woman, the children are all deers. If he be a sachem his brother must succeed him or the son of a sister, or some descendant of a maternal line. His son, having to marry out of the clan, cannot succeed him. But if he marry his son to a bear woman, that is to one of his own clan, his grandson may succeed him, being of the clan of their mother. It is in this way that chieftaincy or sachemship, or property is kept in the family. The daughters in all cases being of the clan of the mother, there would not be much ado in getting rid of daughters. Indeed, women were perfectly free to chose whom they would out of their own clan.

American Copper Artefacts.—A very popular recent work on archæology revives the assertion that the mound-builders understood the art of smelting copper and bronze. It is with very great relief of mind that one turns from the confusing speculations upon which such theories are sought to be erected, and reads the statements of a patient plodder. The bulk of the fifteenth annual report of the Peabody Museum is taken up with a monograph by Professor F. W. Putnam, on the copper objects from South America in the Peabody Museum. The objects described and figured are beads, pendants, plates, bracelets, finger rings, gorgets, bands, tubes, spools, sheaths, ear-rings, celts, spear-heads, knives, harpoons, hoes, club-heads, morning-stars, &c. Concerning all of which we take pleasure in quoting: "In North America, outside of Mexico, before the coming of the Europeans, there is no evidence, as yet, that copper was used otherwise than as a substance which could be hammered and cut into many desirable shapes. * * * The statements about the discovery, in the United States, of copper implements which were unquestionably cast in molds, should be regarded as hasty conclusions until we have other information of the subject than seems yet to have been obtained."

Babylonian Talismans.—No doubt our readers have seen the little stone and clay cylinders, which resemble bits of candle, on which some legend, inscription or writing has been impressed or engraved. Dr. Henry Fischer, of Freiburg, in company with Dr. Alfred Wiedemann in Leipzig, has devoted a quarto monograph to these objects, illustrated by three full-sized photographic plates. These cylinders were among the very first objects which draw attention to the long-forgotten Euphrates valley, brought so prominently to light by the researches of Layard and his suc-

cessors. The mineralogical characters and the lapidary work on the cylinders are described by Herr Fischer and the palæographic portion of the work is by Dr. Wiedemann.

WHITE INDIANS IN SOUTH AMERICA.—Owing to the universal custom of painting their faces and bodies with ochre, the aborigines of our continent got the name of "red men." Prichard (Researches, &c., I, 269) says: "The American races show nearly as great variety in complexion as the nations of the old continent; there are among them white races with a florid complexion," &c. On the same point, see references to Short, Pacific R. R. Rep., Winchell, William Penn, Catlin and Lynd, in Donnelly's "Atlantis," p. 184. We use these references, however, as an introduction to a paper in Das Ausland, 1882, 887–890, by Mr. Albert S. Gatschet upon the same subject. References are there made to Prichard, "Researches," V, 480, '481; Martins, *Beiträge*, II, 87, 211, 214, 385, 525; Herndon and Gibbon, "Explorations," I, p. 206; H. v. Holten, *Ztschrft. f. Ethnol.*, 1877, 105–115; J. D. Cortes, "Bolivia," &c., 1875, 58–70; and to many other original observers. This is an exceedingly valuable monograph.

CANNIBALISM IN NEW ENGLAND.—Mr. Henry W. Haynes read before the Boston Society of Natural History, May 17, 1882, a paper on some new evidences of cannibalism among the Indians of New England from the Island of Mt. Desert, Maine. The sources of the evidence are the shell-heaps, and the witnesses are crushed human bones among the remains of feasts.

THE BROOKVILLE SOCIETY OF NATURAL HISTORY.—The thing which lay nearest to Professor Henry's heart was the fostering of local scientific societies. At Brookville, Indiana, we have one of these thriving institutions supported entirely by gentlemen engaged in arduous professions. Mr. A. W. Butler is the president, to whom we are indebted for notes on Mexico, and Dr. George Homsher the archæologist, who has prepared a complete map and description of Franklin county.

MEXICAN ARCHÆOLOGY.—The Anales del Museo Nacional de Mexico has commenced its third volume, the first part being devoted entirely to archæology in the following papers:

1. An important find; An elegant feather cape, by J. Maler.
2. The Sun Tablet, by Alfredo Chavero.
3. Colossal statue of the Goddess of Water, by J. Sanchez.
4. Myths of the Nahuas, by Gumesindo Mendoza.

ANTHROPOLOGY IN FRANCE.—The Anthropological Society in Paris, like all other flourishing scientific societies, has its Bulletins and its Memoirs. But in Paris they go further, they have a Museum of Anthropology and a regular faculty, who deliver courses of lectures each year upon some division of the subject. To crown the edifice they issue a quarterly journal, called *Revue*

d'Anthropologie, founded in 1872, by Paul Broca, and edited by Paul Topinard. In this review will be found original papers, criticisms, revue préhistorique, revue des livres, revue des journaux, correspondence and bibliography. It would be hard to find a more comprehensive and reliable periodical. The last number of 1882 furnishes the following original papers:

1. List of Broca's craniometric measures and processes. By Paul Topinard.
2. Customs of the Japanese: wife, daughter, child, costume, food, &c. By G. Maret.
3. Muscular variations in the races of men. By T. Chudzinski.
4. Populations of the Balkan peninsula. By G. Lejean.

REPORT OF THE PEABODY MUSEUM.—Mr. George Peabody, in 1866, gave $150,000 to found a museum of archæology and ethnology. The building erected on the grounds of Harvard University now contains a collection second only to that in Washington. The fifteenth Annual Report, by Professor F. W. Putnam, contains the balance sheet, the announcement of the curator, a list of donations and a communication of sixty-six pages by Mr. Putnam, upon copper objects from North and South America. This is, without doubt, the most valuable publication in existence upon this subject, and we shall recur to it in a subsequent number of the NATURALIST.

THE AMERICAN ANTIQUARIAN.—The Rev. S. D. Peet, with indefatigable energy has succeeded in founding a quarterly magazine upon American aboriginal history, that has just entered upon its fifth volume. After migrations as numerous as those of some of the tribes it immortalizes, it has settled down in Chicago, not to perish, however, like the aborigines, but to renew its youth. In the present number will be found Mr. Hale's paper on Indian migrations evidenced by language, Mr. Barney's on native races of Colombia, Mr. Peet's on Ancient village architecture in America, Mr. Read's on an Aztec town in New Mexico, and Mr. Gatschet's on the Chumeto language (California). The number also furnishes linguistic notes, ethnographic notes and book reviews.

POPULAR ETHNOLOGY.—The term "popular ethnology" is susceptible of several meanings, to wit., ethnology which is popular, whether good or bad; attempts to popularize ethnology by scientific writers; or contributions to ethnology by those who write for the people books of travel, &c. It is to the last named class we now refer. Some of the most delightful tidbits of information upon subjects often hard to get at are to be found in popular works. We have one before us now, entitled "Among the Sioux of Dakota; eighteen months' experience as an Indian agent," by Capt. D. C. Poole, 22d Infantry, U.S.A., published by D. Van Nostrand, N. York. The author treats his subject in a very fair-minded way, draws in a graphic manner his picture of Indian government, dress, habitations, their hospitality, bravery and en-

durance, and of the virtue and faithfulness of the women. On the other hand, his eyes were fully open to the disturbing element of the encroaching superior race. The various schemes for meeting this difficulty are also considered, and wise suggestions made for their adjustment.

DAWKINS ON THE ANTIQUITY OF MAN.—In the course of his address before the British Association, on the present phase of the antiquity of man, Prof. W. Boyd Dawkins took the ground that the Trenton River stone implements of New Jersey were contemporaneous with those of the River Somme in France, while he did not accept the Pliocene age of man in California, claimed by Whitney and others. He thus concludes his interesting address:

"It remains now for us to sum up the results of this inquiry, in which we have been led very far afield. The identity of the implements of the River-drift hunter proves that he was in the same rude state of civilization, if it can be called civilization, in the Old and New Worlds, when the hand of the geological clock pointed to the same hour. It is not a little strange that his mode of life should have been the same in the forests to the north and south of the Mediterranean, in Palestine, in the tropical forests of India, and on the western shores of the Atlantic. The hunter of the reindeer in the valley of the Delaware was to all intents and purposes the same sort of savage as the hunter of the reindeer on the banks of the Wiley or of the Solent. It does not, however, follow that this identity of implements implies that the same race of men were spread over this vast tract. It points rather to a primeval condition of savagery from which mankind has emerged in the long ages which separate it from our own time. It may further be inferred, from the wide-spread range, that the river-drift man (assuming that mankind sprang from one center) must have inhabited the earth for a long time, and that his dispersal took place before the glacial submergence and the lowering of the temperature in Northern Europe, Asia and America. It is not reasonable to suppose that the Straits of Bering would have offered a free passage, either to the river-drift man from Asia to America, or to American animals from America to Europe, or *vice versa*, while there was a vast barrier of ice or of sea, or of both, in the high northern latitudes. I therefore feel inclined to view the river-drift hunter as having invaded Europe in pre-glacial times along with the other living species which then appeared. The evidence, as I have already pointed out, is conclusive that he was also glacial and post-glacial. In all probability the birthplace of man was in a warm if not a tropical region of Asia, in "a garden of Eden," and from this the river-drift man found his way into those regions where his implements occur. In India he was a member of a tropical fauna, and his distribution in Europe and along the shores of the Mediterranean prove him to have belonged

either to the temperate or the southern fauna in those regions. It will naturally be asked, to what race can the river-drift man be referred? The question, in my opinion, cannot be answered in the present stage of the inquiry, because the few fragments of human bones discovered along with implements are too imperfect to afford any clue. Nor can we measure the interval in terms of years which separates the river-drift man from the present day, either by assuming that the glacial period was due to astronomical causes, and then proceeding to calculate the time necessary for them to produce their result, or by an appeal to the erosion of valleys or the retrocession of water-falls. The interval must, however, have been very great to allow of the changes in geography and climate, and the distribution of animals which has taken place—the succession of races, and the development of civilization before history began.

MICROSCOPY.[1]

PREPARATION OF MARINE ALGÆ.—It is not strange that an institution which produces more original work than any other in Europe, should be prolific in the *methods* of research.

To the many valuable methods originating in Professor Dohrn's Station at Naples, which have already been summarized in this journal, we have now to add another, which may be of considerable importance to zoölogists as well as botanists.

Working under the inspiration of Dr. Paul Mayer, Dr. Berthold[2] experimented with iodine and other re-agents on delicate marine algæ. The aim was to find solutions that would produce the least possible disturbance in the structure of the cell-protoplasm. It was found that satisfactory results could not be obtained with the ordinary aqueous solutions of picric acid, osmic acid, etc. The disturbance of the osmotic equilibrium, on transferring delicate cells from sea-water to fresh-water solutions, resulted in intra-cellular derangements. Parallel trials were therefore made of picric acid, osmic acid and iodine, three different solutions of each being made; one in distilled water, one in alcohol, and another in sea-water. The solutions in distilled water and alcohol proved almost worthless in each case, while each of the solutions in sea-water gave good results. It was found, curiously enough, that the protoplasm of the cells was more easily injured than the nuclei and karyokinetic figures.

Solutions of osmic acid and corrosive sublimate in sea-water gave good preparations, but the iodine solution was regarded as the best (re-agent).

A few drops of a saturated alcoholic solution of iodine,

[1] Edited by Dr. C. O. WHITMAN, Newton Highlands, Mass.

[2] Pringsheim's Jahrbücher für wissenschaftliche Botanik. Vol. XIII., pp. 704-5, 1882.

added to the sea-water, gives the desired results. The algæ remain in the solution ½–1 minute, and are then transferred directly into 50 per ct. alcohol.

A NEW METHOD OF PRESERVING AND STAINING PROTOZOA.—For preserving these small organisms, various re-agents have been recommended. Certes[1] and Landsberg[2] employ osmic acid; Korschelt,[3] chromic acid or osmic acid; and Entz,[4] Kleinenberg's picro-sulphuric acid.

Finally, Blanc[5] recommends the following very dilute picro-sulphuric solution:—

Picric acid (saturated solution in dist. water)	100 vol.
Sulphuric acid (concentrated)	2 vol.
Distilled water	600 vol.

To this solution, which may be employed as it is for the larvæ of Echinoderms, Medusæ and Sponges, a little acetic acid (1 per ct.) is added for Rhizopods and Infusoria—two or three drops for 15 grams of the solution. The acetic acid is added in order to sharpen the outlines of the nuclei and nucleoli.

This liquid is preferable to osmic acid, because it does not render the objects non-receptive to staining fluids.

The entire process of hardening, washing, staining and mounting can be more expeditiously performed under the cover-glass than otherwise. The acid is allowed to work until the objects have become thoroughly yellow. The acid is then replaced by 80 per ct. alcohol, frequently renewed until the yellow color entirely disappears: 96 per ct. alcohol is next used, and then absolute alcohol.

The hardened objects may be stained with picro-carmine, or, better, with an alcoholic solution of safranin. Five grams of safranin are dissolved in 15 grams of absolute alcohol; the solution left standing a few days, then filtered and diluted with half its volume of distilled water.

This solution of safranin is preferable to picro-carmine, because it colors more quickly, and because one can so regulate its action as to give a sharp definition to the protoplasm or the nucleus.

After the object has been more or less deeply stained, according to the end in view, it is washed in 80 per ct. alcohol, which is renewed until a moment arrives when no visible clouds of color appear; at this moment the 80 per ct. alcohol is replaced with absolute alcohol, and this by clove oil.

As safranin is soluble in alcohol, the process of washing will of

[1] Compt. Rend. Acad. Sc., Paris, t. 88.
[2] Zoöl. Anzeiger, No. 114.
[3] Zoöl. Anzeiger, No. 109.
[4] Zoöl. Anzeiger, No. 96.
[5] Zoöl. Anzeiger, No. 129.

course remove or weaken the color; but decoloration is gradual, so that one needs only to watch and apply the clove oil when the color has been reduced to the desired intensity. This process then, as has already been explained in the October number of this journal, p. 779, consists in *over-staining* and then *removing* the color to any desired degree. The process of decoloration is not entirely arrested by the application of clove oil, contrary to Blanc's assertion, hence it should be replaced by Canada balsam as early as possible. The same method is adapted to other microscopic animals.

——:o:——

SCIENTIFIC NEWS.

— That measles is a disease of parasitic nature, has been held by Herr Tschamer, who found a small organism in the urine of persons having scarlatina, and the same in cases of measles and diphtheria. M. Le Bel, however, has lately found a vibrion peculiar to measles; it is a short, slightly curved rod, highly refringent, and very slow in movement. Its spores are held in a pouch of dead protoplasm, which gradually disappears. Usually these vibrions appear in the urine and during a few days at first; they dissappear when the fever comes. In one case another occurrence of spores was observed on the thirty-fifth day in an adult, and the vibrion persisted. To have an idea of the intensity of the disease, it is well to examine the urine immediately after emission. Again, vibrions were found in the skin at the time of desquamation (scaling). M. Le Bel cultivated the organism in a mixture of urine and bouillon, and injected some of the liquid into a guinea-pig. The animal was not inconvenienced; but on the tenth day thin vibrions were noticed in its urine; they disappeared on the twelfth.

— Among the results obtained by the Prehistorical Commission of the Imp. Geological Institute of Vienna, in 1881, was the continued investigation of the Vypustek cave in Moravia, which brought to daylight a great number of interesting remains of mammals. The most remarkable among them is a nearly complete skeleton of a not yet full-grown diluvial "steinbock" (*Capra ibex* L.), exceeding considerably in size the actually living species. The Gutsch cave, also in Moravia, has been found to include bones of man, reindeer, Aurochs and cave-bear. A number of remains of cave-bear, and of small rodent mammals has been found in the Lettenmaier cave (Upper Austria) which, in prehistorical times, may have occasionally served as a hiding-place to human beings.

— Mr. Fr. Heger extended his researches to new-found burying-grounds near Hallein (Salsburg), a part of a ground, includ-

ing urns, near Reudorf (Bohemia), and to the partly uncovered old burying-hills near Winklarn (Infer. Austria). The investigations in Carniolia, conducted by M. F. Schulf, proved eminently successful. Three tumuli have been opened, containing many sepulchral urns, iron and bronze objects and glass and yellow amber pearl. Director F. de Hochstetter himself conducted the diggings near Watsch. Eighty burial-places with as many urns, filled with ashes and burnt bones, and several others, containing skeletons were brought to daylight. Many well-preserved bronze fibulæ of different pattern, iron points of lances and celts have been found, together with a bronze helmet with double crest, quite like one from the burial ground near Hallstatt (Upper Austria). During the winter of 1881 to 1882, a shepherd dug out a kettle, made of laminated silver, adorned with figures, now in the Provincial Museum of Saibach (Carniolia).—*Communicated by Dr. F. V. Hayden.*

— The city of Neuchatel on the 6th of December, celebrated the fiftieth anniversary of the foundation of its natural history society. M. Jules Marcou, in a letter to the *Nation*, recalls the fact that the society was founded under the leadership of Agassiz, then twenty-five years old, having returned from his studies in Paris, under Cuvier and Humboldt. The orator of the day, Prof. Louis Favre, in his historical sketch of the society, enumerated the scientific enterprises of the young Agassiz, particularly of his glacial theory, which he first suggested at Neuchatel in 1837, Agassiz then declaring "that there has been a time when glaciers covered the whole area of the Alps, and extended far beyond; that there had been in Europe a period of great cold, a 'Great Ice age,' when the mammoths lived." How he extended the theory to Northern Europe and the British Isles and to North America as the result of personal observation is a matter of common scientific history.

— The endowments at the French Academy by the government are thus described by the *Academy*. Each member of the Institut receives an official salary of 1500fr. When full, the Institut has 228 members, being sixty-eight for the Académie des Sciences, and forty for each of the other branches. The total grant, therefore, on this account would amount to nearly £14,000 a year. And there are not a few extra items. The members of the Académie Française receive a payment for attendence or "jeton de presence," which raises their salary to 5000fr. Five of their body charged with the secular compilation of the dictionary get an additional 1500fr.; those who are engaged upon a history of French literature get 2400 fr.; four members of the commission of medals get 800fr. each; and 5000fr. is allotted for a dictionary of fine arts.—*The Academy.*

— In a paper on the early votaries of science in Rhode Island, read by Dr. Parsons, before the Rhode Island Historical Society, he remarked "that Rhode Island furnished, from the pen of her founder, the earliest American contribution to philology; that she took part in suggesting the first great physical discovery made in these colonies—that of the relation of electricity to lightning; that she witnessed the first botanical garden, the first public lectures on anatomy and the first professorship of natural history in New England, and, finally, that one of her sons, whose medical education was begun upon her soil, and 'ripened in the skies of many lands,' was the first American to appreciate the value of vaccination, began its application by submitting his own son to the repulsive experiment, and succeeded in establishing it, through doubt and obloquy, in public and lasting confidence."

— The citizens of Montreal, says the *Popular Science Monthly*, have begun their preparations to receive the British Association in 1884, by sending out circulars to inform their invited visitors that the city can take care of them, and that they will find their visit a pleasant one. Among the inducements held forth are easy excursions to Quebec and Ottawa and longer and pleasant ones to Toronto, Niagara Falls, Boston, New York and New Haven, or whatever Eastern city the American Association may meet in. The government of the Dominion is expected to make liberal grants of money to defray the expenses of British members, the railroads and steamboats will provide excursions to the great lakes and Chicago, and to the provinces of the north-west as far as the Rocky mountains; and the association is promised its usual revenue from the meeting.

— The subscription for the Darwin memorial has awakened so much enthusiasm in Sweden, says *Nature*, that 1400 persons, "from the bishop to the seamstress," have contributed sums "varying from five pounds to two pence." In Great Britain 600 persons have contributed to the fund, and many in Germany. The average intelligence of the people of Denmark, relating to scientific matters, is shown by the ample support, as the editors write us, which is given to the Danish Natural History Journal by a population numbering 1,784,741 souls. We wish as proportionately large a subscription list for the AMERICAN NATURALIST could be made up in a population of 50,000,000! Those who oppose State and town aid to higher schools little know what they are doing to reduce the average education of our people.

— New facts concerning rabies in various animals have been presented to the French Academy by M. Pasteur, with MM. Chamberland, Roux and Thaillier. All forms of rabies, they claim, come from the same virus. Death, after inoculation with

rabid saliva, may be either from a microbe found in the saliva, from formation of much pus, or from rabies. The virus of rabies is found not only in the medulla oblongata, but in the brain and spinal cord. Animals sometimes recover after the first symptoms of rabies, never after the acute symptoms. The authors have now four dogs which cannot take rabies, however inoculated; whether this is from having had a mild form of it and recovered, or from being naturally refractory, they cannot at present say.

— The venous blood of a horse that recently died of rabies, at Dinan, was examined by M. Barille with a magnifying power of 1200 diameters and an immersion objective. It was found to contain an innumerable quantity of small organisms (vibrions and bacteria) endowed with motion. The corpuscles, especially the white ones, were profoundly altered; these (white) were much more numerous than usual. Further, there were a number of ovoid corpuscles, about two-thirds or three-fifths of the size of the blood corpuscles, with one to three budding appendices. Hallier has described this vegetal ferment of rabid blood, and he calls the fungus Lyssophyton. Lastly, the blood contained a great deal of hæmoglobin.

— The advantage of planting trees in streets and open spaces in towns has been the subject of correspondence in the local press of Geneva. Dr. Piachaud concludes that trees in streets do more harm than good, because they impede the circulation of air. Professor Goret, on the contrary, says that trees temper the heat and serve as a protection from dust, while the evaporation from their leaves helps to keep the air cool and moist. He also contends that by means of their roots they draw up stagnant waters and absorb much of the filth which would otherwise render the subsoil of streets a dangerous nidus for disease.

— While the sand-storm was raging in Kern county a few days since it was raining in Fresno county a hundred miles further north. The sand was carried by the Kern-county storm up into the upper stratum of air, when it was carried northward, and coming into the rain-storm of Fresno county, descended with the rain. The *Expositor* mentions the fact of a mud-storm, but cannot account for the real estate portion of the mixture.—*California paper, Feb. 10.*

— Three numbers of *Science* have been received. This is a weekly journal corresponding to the English *Nature*. It is published at Cambridge, Mass., by Moses King, and edited by S. H. Scudder. Short articles, book reviews and correspondence fill the first half of the number, while the second half is devoted to a weekly summary of progress in all departments of physical and natural science. Such a journal was needed, and will doubtless be well sustained.

— Another journal, of which we have received Nos. 1 and 2 under the same cover, is the Bulletin of the Buffalo Naturalists Field Club. The ornithological, botanical and especially Dr. Kellicott's notes on the early stages of certain caterpillars, are particularly good. Some of the articles have a pleasant literary flavor.

— Professor R. Owen, the veteran comparative anatomist, though seventy-nine years old, is still in good health and publishing important papers. Rumors of his ill health are contradicted, we are glad to see, by *Nature*.

— A most interesting paper by Commander J. R. Bartlett, U. S. N., assistant in the Coast and Geodetic Survey, on the Gulf stream, appears in the Bulletin of the American Geographical Society.

— A third issue is S. E. Cassino's *Scientific and Literary Gossip*, edited by J. S. Kingsley. It appears once a month and contains selected and critical articles.

— Professor P. A. Chadbourne, who died on the 16th of Feb., was lately president of Williams College, and at the time of his death president of Massachusetts Agricultural College. He was in earlier years a zealous and successful teacher of science. He gave moral and pecuniary aid to struggling students of science, and though he spent little time in original research, he aided younger men in their studies. He led the Williams College expedition to Labrador and Greenland in 1860, when considerable material new to science was collected and worked up by those attached to the expedition.

— We neglected to record the death last year of Professor Leith Adams, the author of a work on tertiary mammals of Malta, and of works of travel, one relating to New Brunswick, where he resided for a period. His chair of Natural History at Queen's College, Cork, has been filled recently by the appointment of M. M. Hartog.

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PROCEEDINGS OF SCIENTIFIC SOCIETIES.

PROCEEDINGS OF THE PHILADELPHIA ACADEMY OF SCIENCES, July 25.—Mr. Meehan stated that a *Broussonettia papyrifera* had recently fruited Though the plant had been introduced a hundred years, only males had hitherto been known, so that a change from male to female had in this instance taken place.

Aug. 8.—The Rev. H. C. McCook described the raids of *Formica sanguinea* upon *F. fusca*—raids in which the black slaves assist their red masters. Reds and blacks shared the labor of raising the young. The nests of *F. fusca*, conspicuous in places

where there were no red ants, were hard to find where the latter were common. An attempt to introduce the red ant into a city yard, failed through the attacks of the common pavement ant, *Tetramorium cæspitum.*

Aug. 15.—Mr. Meehan exhibited some flowers of *Helianthus mollis,* and informed the academy that out of sixty-eight flowers in his garden, all but two faced south-east, although to so face they had to make a circuit.

Aug. 22.—Dr. Leidy stated that a parrot, eighty years of age, required the food to be placed in its mouth, as was the case with pigeons which have been deprived of their brains. That mammals lived longer before man interfered with them, was shown by the wear of the crowns of fossil teeth.

Sept. 5.—A paper entitled "*Conchologia Hongkongensis,*" by S. W. Eastlake, was presented.

Sept. 19.—A paper was presented from Mr. R. E. C. Stearns, upon the verification of the habitat of Conrad's *Mytilus bifurcatus* Mr. Meehan stated his belief that the want of trees upon the prairies was due to nothing but the annual Indian fires; he believed the Indians existed prior to the recession of the lakes of the prairie region; his remarks applied especially to Illinois; Professor Lewis stated that evidences of glacial action abounded in Illinois, while there was no evidence that man was pre-glacial. Dr. Leidy described *Acyclus inquietus,* a rotifer with a finger-like process instead of ciliary disks, and gave particulars of other rotifers without rotary organs.

Sept. 26.—Dr. Leidy presented a paper entitled "Rotifers without rotary organs."

Oct. 3.—Dr. Skinner remarked that the organs of offence of the larva of Papilio, usually believed to be solid, is really hollow, rolled in and out upon itself. Dr. H. Allen spoke upon the asymmetry of the nasal organs, exhibited principally by the septum, which in most human skulls is deflected; a portion of the lining membrane has an erectile character, which is probably protective. Mr. Meehan stated that at Atlantic City he had closely examined some markings on the sand, usually believed to be the tracks of birds, and had found that they were due to the action of water on sand tenanted by colonies of *Hippa talpoides.*

Oct. 10.—Drs. Wood and Formad presented a paper upon the nature of diphtheria, and the Rev. H. C. McCook another upon the snares of orb-weaving spiders. Dr. Wood stated that the cinchonaceous plant "Remigia," the bark of which yields two per cent. of quinine and a peculiar alkaloid known as *cinchonanine,* was probably capable of cultivation in many parts of the Southern States and in California. The Rev. H. C. McCook described four species of Epeira, *E. gemma* from Colorado, *E. conifera, E. harrisonæ* from New Hampshire, and *E. bicentennariæ.*

Oct. 17.—Mr. Meehan stated that an isolated Ginko tree, in

Kentucky, had fruited; *Cephalotaxis fortunii* had been proved monœcious, and he believed that all conifers were probably so. Dr. Leidy described *Pyxicola annulata*, an infusorian with a chitinous shell, which it can close with a kind of operculum; it lives upon plumatella. Professor Heilprin spoke upon the fossil shells of the Claibone beds of Texas.

Oct. 31.—The Rev. H. C. McCook drew attention to the use of ants as insecticides by Chinese, and stated his belief that as no American species lived on trees, the probabilities were against their usefulness for a similar purpose.

Nov. 7.—The following papers were presented: "Revision of Swainson's genera of fishes," by Jos. Swain; "Ants as beneficial insecticides," by the Rev. H. C. McCook, the latter of whom advocated the importation of the ant used in China for the protection of orange trees. Professor Koenig spoke of the common occurrence, in West Philadelphia, of enclosures of biotite in muscovite.

Nov. 14.—Mr. Meehan stated that the nest of the wood pewee is not held together by any viscid secretion, but by cobwebs.

Nov. 21.—Mr. Wortman declared that the fossil *Ursus amphidens* described by Dr. Leidy in 1853, was probably identical with the variety of *D. ferox* now living in the same district, viz., the eastern slope of the Rocky mountains; Dr. Leidy endorsed Mr. Wortman's conclusion. Mr. Townsend called attention to the rapidity with which the lost fangs of the rattlesnake were replaced, and mentioned a case in which they had been extracted and re-developed six times.

Nov. 28.—Professor Koenig objected to Reinsch's views of the microscopic structure of coal.

Dec. 5.—Dr. Horn remarked upon the singular distribution of the apterous water-beetle Amphizoa, one species of which inhabits California, a second the district northward of that State as far as Vancouver's island, while a third has been found high up in the mountains of Thibet. Mr. Meehan exhibited a specimen of *Acroclinium rosea*, some of the flowers of which were made double by the development of the chaffy scales of the receptacle. Professor Cope presented a paper upon Uintatherium, Bathmodon and Triïsodon, and gave the substance of it verbally.

Dec. 12.—Papers upon the identification of the species of fishes in Shaw's General Zoölogy, by Jos. Swain, and on the value of the Nearctic as a zoölogical region, by Professor Heilprin, were presented. Dr. Leidy made some remarks upon the fossil Equidæ of North America, and said that it was difficult to tell whether fossilized bones of Equus belonged to the recent species or to the extinct one that so nearly resembled it. Professor Cope believed that the coincident existence of man and of the horse on this continent would yet be demonstrated. The California gold-bearing gravels contain the remains of both. The first travelers who as-

cended the Paraguay twenty years after the discovery of America, reported that they found horses in abundance. He had reason to believe that the foot of *Orohippus* Marsh, did not differ from that of *Hyracotherium*. Specimens collected in the Laramie beds by Mr. Wortman strengthened his belief in their Cretaceous age. A genus of Mammalia had been discovered by Mr. Wortman, which he named *Meniscoëssus*. Its molar teeth resemble that of *Stereognathus* Ow., of the Oolite. Professor Heilprin stated his belief, from a comparison of the Mammalia, that the Nearctic should be considered to form a portion of the Palæarctic, and proposed the name Triarctic to include both. Professor Cope dwelt upon the distinctness of the Nearctic reptiles and fishes from those of the Palæarctic. Dr. Horn said that the coleoptera found north of the St. Lawrence were likely to occur also in the north of Asia, while those found south of that river were more closely allied to those of Mexico. The general character of the Japanese coleoptera was similar to that of the eastern United States. The Rev. H. C. McCook stated that the distribution of ants supported Professor Heilprin's position, but that there was not the same correspondence between the spiders of the two regions. Mr. Tryon declared that the northern part of both continents contained the same genera and even the same species of mollusks, but that farther south the differences increased.

Dec. 19.—Dr. H. Allen spoke of the irregularity of the folds of the hard palate and the assymmetry of the dental arch, and exhibited casts; in the embryo six regular curves range across the palate, but at birth these have become irregular; the speaker gave names to the several rugæ. Professor Cope exhibited remains of *Meniscotherium terrærubræ*, a genus near Hyrax, and belonging to the division Condylarthra; the teeth are tapiroid in character. Dr. Leidy described a new species of extinct peccary *Platygonus vetus*, from Mifflin county, Pa. Miss Lewis gave the result of her studies of the plumage of birds, and showed that varying colors were produced by peculiar arrangements of barbules. Professor Heilprin considered the distribution of the Batrachia and Reptilia, and contended that it supported his view of the sub-regional character of the Nearctic.

Dec. 26.—Professor Lewis presented a paper upon "Enclosures in Muscovite," and Alexis A. Julien another upon the "Genesis of Crystalline Iron Ores."

Jan. 9.—Professor Cope presented a paper upon the distribution of the Batrachia and Reptilia in western North America. Mr. Wortman drew attention to the fact that the museum contained a skull of *Canis lupus*, possessing a third molar in the upper jaw. Dr. Leidy mentioned that he knew of an adult man with only one incisor and two premolars on each side of each jaw. Professor Cope said that he had seen a large dog with four inferior true molars.

Jan. 16.—A paper on *Quercus durandii*, by S. B. Buckley, was read.

Jan. 23.—Dr. Skinner stated that *Argynnis cybele*, instead of carefully depositing the eggs, as is usual with butterflies, dropped them from a distance upon the herbage.

Jan. 30.—Papers were presented on *Urnatella gracilis*, by Dr. Leidy, and on the terrestrial Mollusks of the Society islands, by A. Garrett. Mr. Townsend exhibited a hybrid between the snow-bird and the white-throated sparrow, and stated that the hybrids between North American birds appeared to be rare. Professor Lewis presented a rudely beveled piece of sandstone from the Philadelphia red gravel. It was believed to be artificial. Mr. Potts stated that he had examined the dam and reservoir at Fairmount for sponges, to find whether the decay of these organisms contaminated the water. *Myonia leidyi*, the most abundant, was a close-grained sponge, with but little sarcode; he did not believe decaying sponges caused the pollution of the water.

Feb. 6.—Professor Cope described a new extinct genus and species of Sirenia under the name of *Dioplotherium manigaulti*. Professor Leidy exhibited some Anodontas six inches in length, from a pond in New Jersey, and Professors Lewis and Heilprin identified them with a species found in the pre-glacial clay.

Biological Society of Washington, Feb. 16.—Communications were as follows: Discussion of Dr. Coues' paper on zoölogical nomenclature applied to histology; Mr. Newton P. Scudder on biology and classification; Mr. John A. Ryder on the structures of protoplasm and karyokinesis.

March 2.—Professor Otis T. Mason on the human fauna of the District of Columbia; Dr. Thomas Taylor on section cutting and mounting of hard woods, with illustrations; Dr. M. G. Ellzey on hybrid sterility.

New York Academy of Sciences Feb. 12.—The following papers were read: Minerals from the Weehawken tunnel (with exhibition of specimens), by Mr. B. B. Chamberlin; On the geology and ore-deposits of Northeastern Chihuahua, by Dr. John S. Newberry.

Appalachian Mountain Club, Boston, Feb. 14.—Mr. W. H. Pickering read a paper on the winter excursion of the Club, and showed with a lantern some views taken on the trip. A paper by Mr. John Tatlock, Jr., on the principal co-efficients in the barometric formula of Laplace as applied to the White Mountain region was read.

American Geographical Society, Feb. 15. — Commandant Alfred Aylward delivered a lecture entitled, "Dutch South Africa."